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COMPUTER SCIENCE (EM)

9TH CLASS

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Problem Solving

Q1 Define problem. Explain the strategies for defining the problem.

Ans: Defining a Problem

A problem is a hurdle which needs to be removed. Problem solving is a skill to approach the solution of a given problem and it can be developed by following a well organized approach. A well defined problem is the one that does not contain ambiguities. All the conditions are clearly specified and it has a clear goal. It is easy to understand and solve.

Strategies to define the Problem

Given a problem statement, we first need to see whether the problem is defined well or not. If the problem is not defined well then we can use one of the following strategies to define the problem:

- **Gain Background Knowledge**
  We try to know the situation and circumstances in which the problem is happening. In this way, we can identify the given state. It also helps to know what a good solution will look like. How we shall be able to measure the solution.
- **Use Guesses**
  We try to guess the unknown information through appropriate guesses. These guesses may be bases upon our past experiences.
- **Draw a Picture**
  If the problem is not well defined, we can draw a picture and fill the undefined information.

Q2 Define problem analysis. Explain your answer along with an example.

Ans: Problem Analysis

It is important to understand the problem before jumping into the solution of the problem. A clear understanding of a problem makes it easier to solve and helps to save money, time and resources. In this stage the problem being solved is observed carefully, major areas of concern are identified and irrelevant information is filtered out.

Understanding of a problem usually includes identification of the 5 Ws (What, Who, When, Where and why). Problem analysis is the process to figure out these 5 Ws from a problem statement. Problem analysis helps to understand a given problem. These are the basic elements which lead towards the solution of a given problem.

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Example:

Suppose your class teacher assigns you a task to prepare a list of students in your school whose names start with letter 'A'. The list is required in order to prepare an alphabetical directory of all school students and there is only one week to complete the task. We can analyse this problem by identifying 5Ws in the problem statement as given problem below:

What: List of students' names starting with letter 'A'.
Who: Students
Why: To prepare the directory of students.
When: Within a week.
Where: School

From problem to solution

The above figure shows the metaphorical representation of problem where the red light presents a problem, the yellow light represents its analysis and the green light presents the solution. It shows that problem analysis makes us closer to a solution.

Q3 What is meant by planning a solution? Explain different strategies for planning a solution.

Ans: Planning a Solution

After analyzing a problem, we formulate a plan that may lead us towards the solution of a problem. This phase includes finding the right strategy for problem solving.

Strategies for Planning a Solution

Different strategies for planning a solution are as follows:

a) Divide and Conquer

This strategy divides a complex problem into smaller problems.

b) Guess, Check and Improve

The designer guesses a solution to a problem and then checks the correctness of the solution. If the solution is not according to expectations, then he/she refines the solution. The refinement is an iterative process.

c) Act it Out

In this strategy the designer defines the list of "to-do" tasks. Afterwards he/she performs the task.

d) Prototype (Draw)

This technique draws a pictorial representation of the solution. It is not the final solution. However, it may help a designer to understand the important components of the solution.

The selection of the strategy depends upon the problem. It is quite important that one strategy maybe more suitable to implement a solution than the other one. Very

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معزز ممبران: آپ کا وٹس ایپ گروپ ایڈ من "**اردو بکس**" آپ سے مخاطب ہے۔

آپ تمام ممبران سے گزارش ہے کہ:

- ❖ گروپ میں صرف PDF کتب پوسٹ کی جاتی ہیں لہذا کتب کے متعلق اپنے کمنٹس / ریویوز ضرور دیں۔ گروپ میں بغیر ایڈ من کی اجازت کے کسی بھی قسم کی (اسلامی و غیر اسلامی، اخلاقی، تحریری) پوسٹ کرنا سختی سے منع ہے۔
- ❖ گروپ میں معزز، پڑھے لکھے، سلجھے ہوئے ممبرز موجود ہیں اخلاقیات کی پابندی کریں اور گروپ رولز کو فالو کریں بصورت دیگر معزز ممبرز کی بہتری کی خاطر ریموو کر دیا جائے گا۔
- ❖ کوئی بھی ممبر کسی بھی ممبر کو انباکس میں میسیج، مس کال، کال نہیں کرے گا۔ رپورٹ پر فوری ریموو کر کے کاروائی عمل میں لائے جائے گی۔
- ❖ ہمارے کسی بھی گروپ میں سیاسی و فرقہ واریت کی بحث کی قطعاً کوئی گنجائش نہیں ہے۔
- ❖ اگر کسی کو بھی گروپ کے متعلق کسی قسم کی شکایت یا تجویز کی صورت میں ایڈ من سے رابطہ کیجئے۔
- ❖ سب سے اہم بات:

گروپ میں کسی بھی قادیانی، مرزائی، احمدی، گستاخِ رسول، گستاخِ امہات المؤمنین، گستاخِ صحابہ و خلفائے راشدین حضرت ابو بکر صدیق، حضرت عمر فاروق، حضرت عثمان غنی، حضرت علی المرتضیٰ، حضرت حسنین کریمین رضوان اللہ تعالیٰ اجمعین، گستاخ اہلبیت یا ایسے غیر مسلم جو اسلام اور پاکستان کے خلاف پراپیگنڈا میں مصروف ہیں یا ان کے روحانی و ذہنی سپورٹرز کے لئے کوئی گنجائش نہیں ہے لہذا ایسے اشخاص بالکل بھی گروپ جوائن کرنے کی زحمت نہ کریں۔ معلوم ہونے پر فوراً ریموو کر دیا جائے گا۔

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- ❖ **لیڈیز کے لئے الگ گروپ کی سہولت موجود ہے جس کے لئے ویریفکیشن ضروری ہے۔**
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specifically, the selection of the strategy depends upon the nature of a problem.

Q4 What is meant by defining candid solutions?

Ans: Candid Solutions

The word candid refers to something spontaneous and unplanned. For example, if you are asked to find number of students in your school who can play cricket. You can estimate by finding cricket players in your class and then multiplying it by the total number of classes in your school. Your answer in this way is the candid solution. To find exact number of cricket players, you have to opt some other way, like visiting each class or getting data from teachers. One can think of a candid solution anytime. A candid solution can help to save time.

Multiple solutions of a problem

In above figure, there are different ways shown to reach a certain place (which can be reached either by going across the wall or by going sideways), and the one you think can work, is the candid solution. It is not necessary that the candid solution is the actual solution of a problem.

Q5 What is meant by selecting the best solution?

Ans: Selecting the Best Solution

Sometimes we find more than one solutions of a problem and select the best one amongst them. For example, assume that names of all the students in your school are available on a website and you are asked to search a particular name. You can solve this search problem by either of the following methods:

- Look at each name on the website one by one until the name is found or the list is over.
- Take printouts and search the required name.
- Copy names, put them in Excel sheet and sort there in alphabetical order. Searching in a sorted list is comparatively easy.
- Just press Ctrl + F, when the list is available in a web browser. You can type the name to search automatically.

Levels of a solution

Flow from input to output

Decision Making

To determine whether a statement is true or false, and taking appropriate steps accordingly, is called decision making.

Outputs

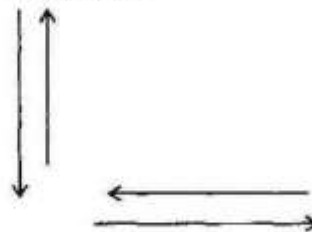
Outputs are used to display information and usually this information exhibits the processed results.

Q8 Explain different symbols of flowchart.

Ans: Symbols of Flowchart.

Flowcharts explain a process clearly through symbols and text. They are usually drawn using some standard symbols. Flowcharts use special shapes to represent different types of actions or steps in a process. Lines and arrows show the flow of steps. Some of the most widely used symbols in flowcharts are as follows:

1 Flow Lines

It is used to determine the flow of steps in a flowchart. We read a flowchart by following the flow lines. A flow line represents a connecting path between flowchart symbols. Flow lines are represented by arrowheads. They are used to show the direction of movement of instructions in a flowchart.

2 Terminal

This symbol is used to represent the start and end of the flow chart. It is represented by an oval shape. Normally every flowchart starts and ends with this symbol.

3 The Processing symbol

The rectangle symbol used in flowchart is the process symbol. It is used in a

flowchart to represent the arithmetic operations and data movement instructions. It represents operations to change values.

SUM = A+B+C+D+D

❹ The Input/output symbol

Problem solving may involve data processing. We get the data, do some calculation and produce the result. In a flowchart, we use parallelogram symbol for input and output. The input symbol is used to mark the point at which we put in data and the output symbol is used to mark the point at which we get the result. It indicates the input of data from user or displaying results to user.

❺ The Decision symbol

There may be a point in our flowchart where the flow lines branch out. At this point we have to decide which way to go. In a flowchart, we use a diamond shaped symbol called the decision symbol. It shows a conditional operation that determines which one of the two paths to take. The operation is commonly a yes/no question or a true/ false test. This is the only symbol which has more than one exit point.

❻ Connector

If a flowchart does not fit on a page, then we use connector to connect parts of a flowchart on different pages.

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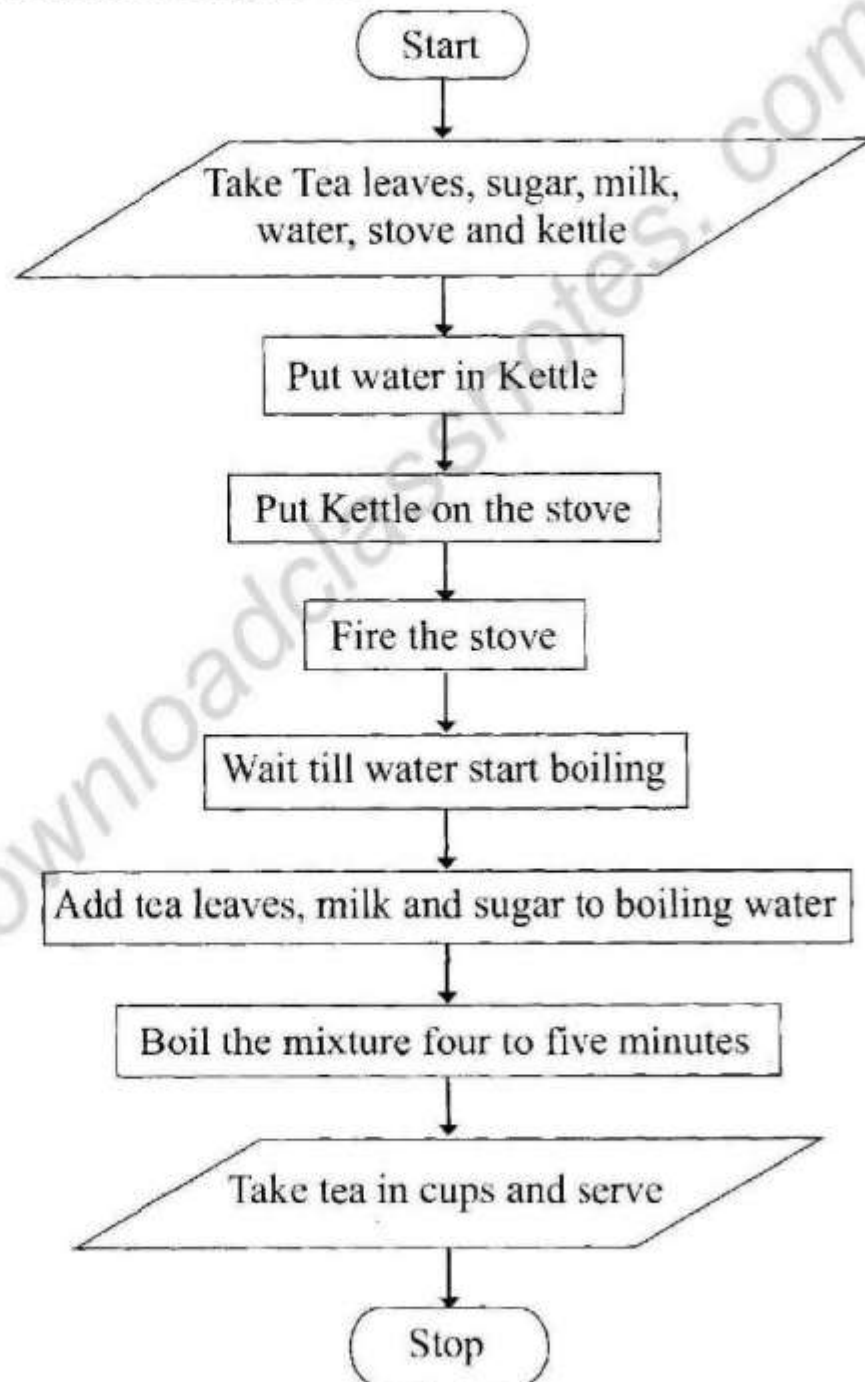
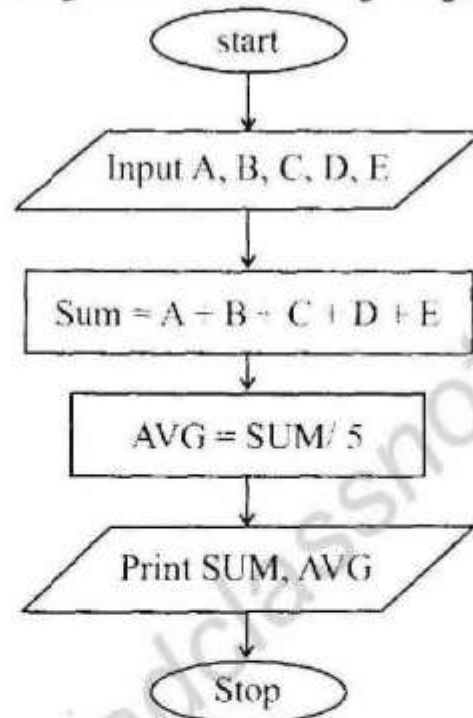
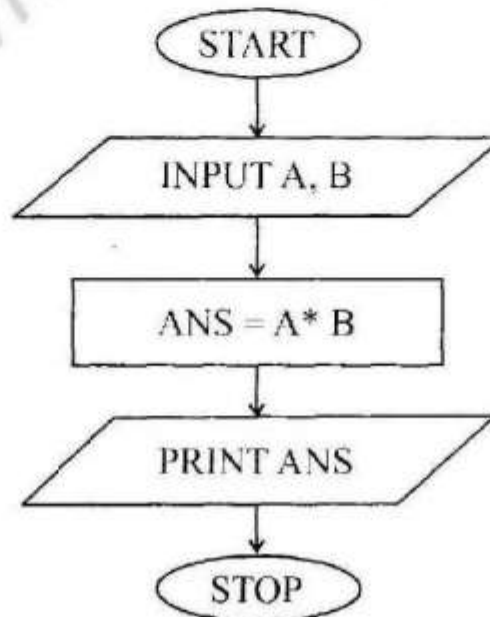
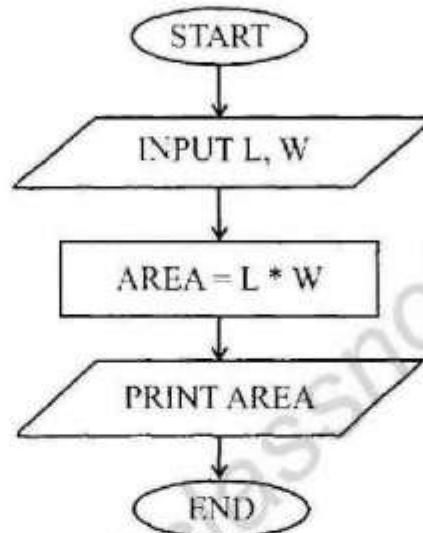
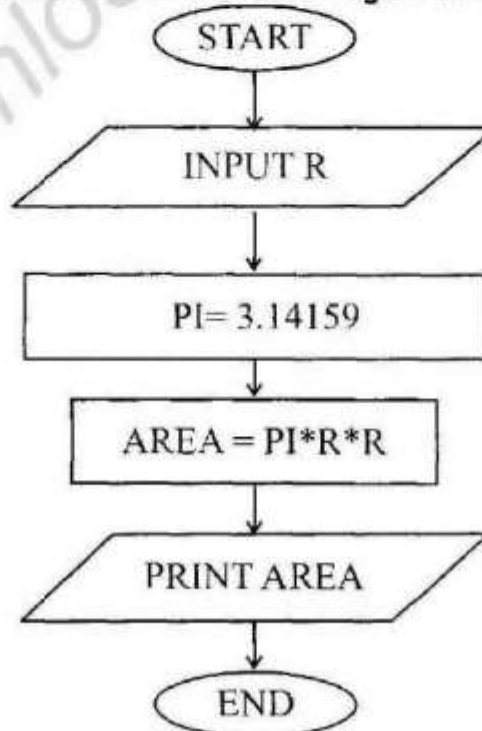
Q9 Draw a Flowchart for making the tea.

Ans: Flowchart for making the tea

Q10 Draw a Flowchart for finding the sum and average of given numbers

Ans: Flowchart for finding the sum and average of given numbers

Q11 Draw a Flowchart for finding the product of two given numbers

Ans: Flowchart for finding the product of two given numbers

Q12 Draw a Flowchart to find the area of a rectangular region with given length and width.

Ans: Flowchart to find the area of a rectangular region with given length and width

Q13 Draw a Flowchart to find the area of a circular region with given radius

Ans: Flowchart to find the area of a circular region with given radius

Q14 Write down the advantages and disadvantages of a flowchart.

Ans: Advantages of a Flowchart

Some advantages of flowcharts are as follows:

- Easy to draw.
- Easy to understand problem solving.
- It helps in debugging process.
- Easy to observe flow from one step to the other.

Disadvantages of a Flowchart

Some disadvantages/limitations of flowcharts are as follows:

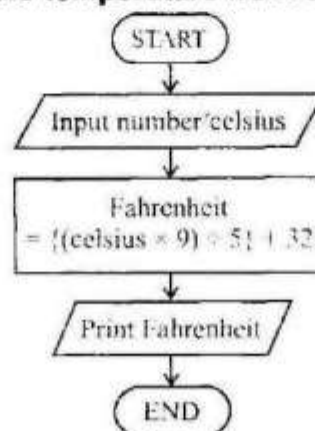
- More time is required to draw a flowchart.
- Modifying a flowchart is not very easy every time.
- It is not suitable for very large and complex problems.

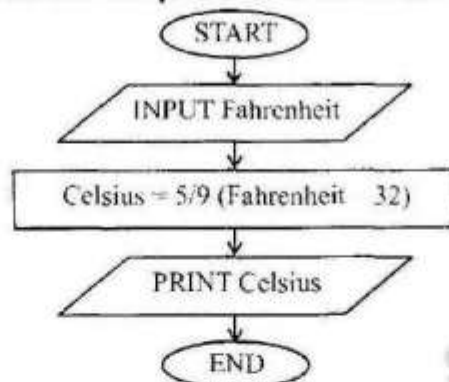
Q15 Write down the guidelines for drawing a flowchart.

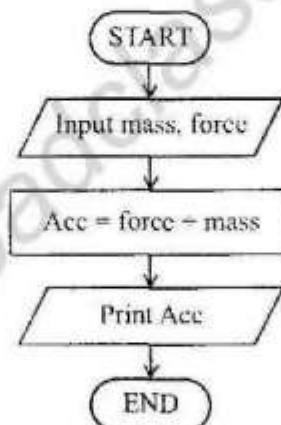
Ans: Guidelines for Drawing a Flowchart.

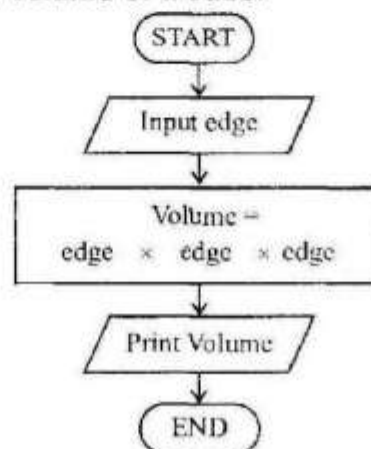
- In drawing a flowchart, all necessary requirements should be listed in a logical order.
- The flowchart should be clear, neat and easy to follow.
- The usual direction of the flowchart is from top to bottom or left to right.
- Only one flow line should come out from a process symbol.
- Only one flow line must enter a decision symbol, but two flow lines, one for each possible answer, must leave it.
- Only one flow line is used in conjunction with terminal symbol.
- Write comments within remarks symbol.
- If the flowchart becomes complex, it is better to use connector symbols to reduce the number of flow lines.
- It is useful to test the validity of the flowchart by passing through it with a simple test data.

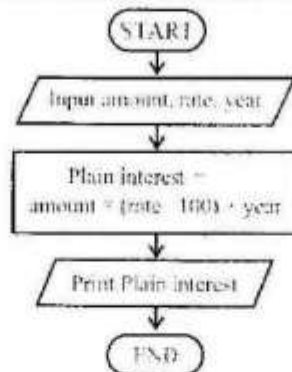
Q16 Draw a flowchart to convert the temperature from Celsius to Fahrenheit.

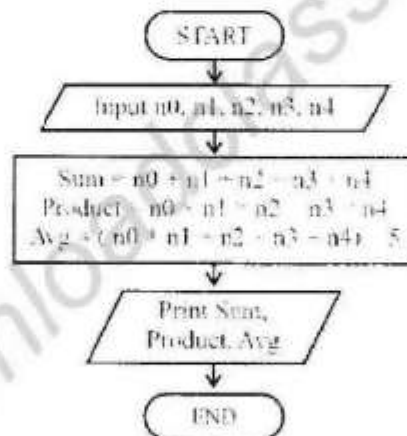
Ans: Flowchart to convert the temperature from Celsius to Fahrenheit.

Q17 Draw a flowchart to convert the temperature from Fahrenheit to Celsius.

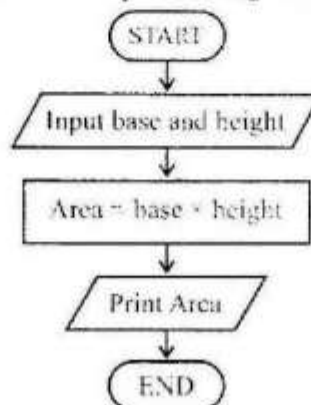
Ans: Flowchart to convert the temperature from Fahrenheit to Celsius.

Q18 Draw a flowchart to find acceleration of a moving object with given mass and the force applied.

Ans: Flowchart to find acceleration of a moving object with given mass and the force applied.

Q19 Draw a flowchart to find the volume of a cube.

Ans: Flowchart to find the volume of a cube.

Q20 Draw a flowchart to find plain interest on an amount.

Ans: Flowchart to find plain interest on an amount.

Q21 Draw a flowchart to find the sum, product and average of five given numbers.

Ans: Flowchart to find the sum, product and average of five given numbers.

Q22 Draw a flowchart to find the area of a parallelogram.

Ans: Flowchart to find the area of a parallelogram.

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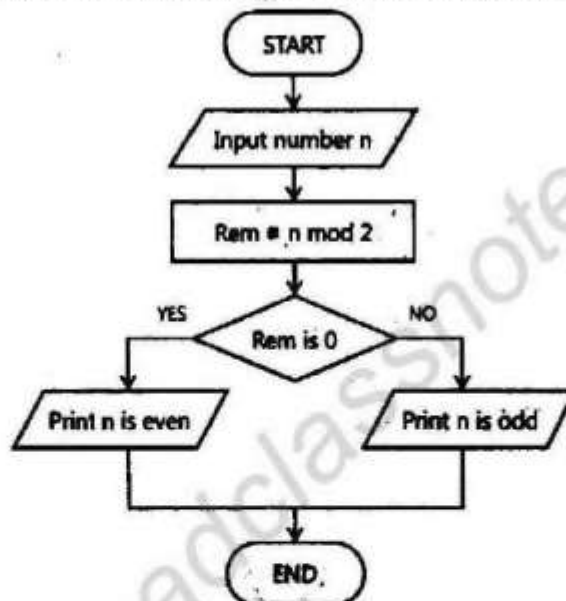
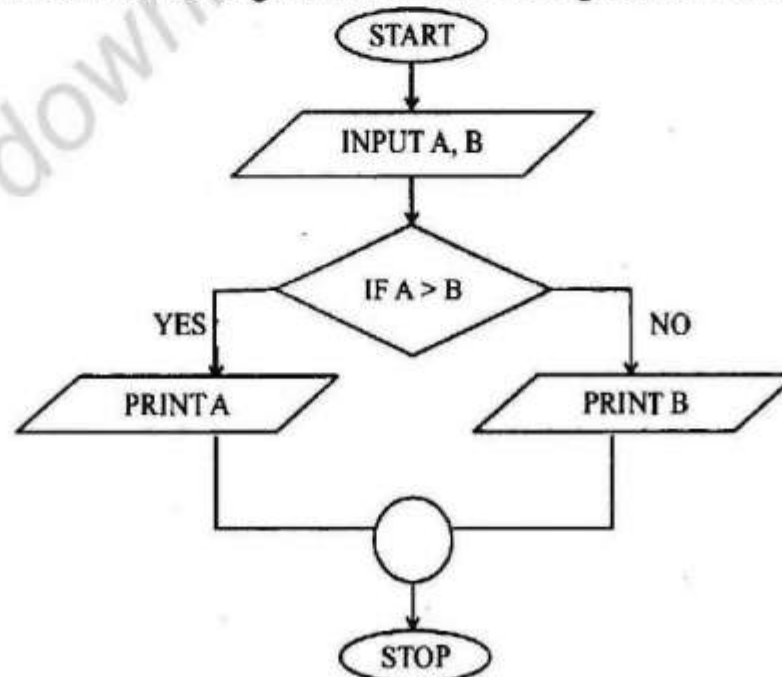
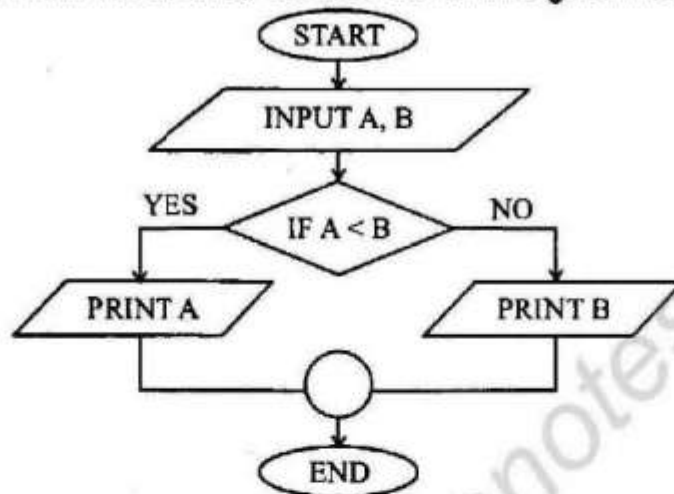
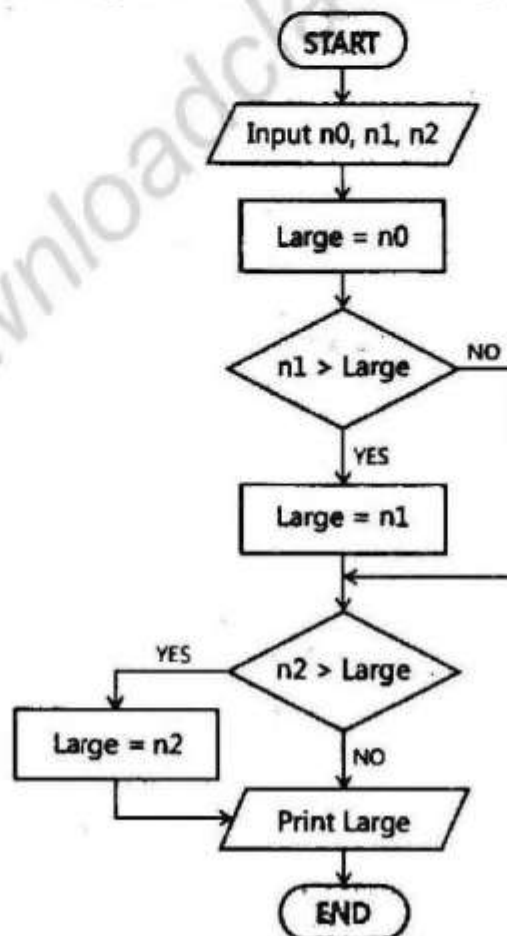
Q.23: What is meant by conditional flow in flowcharts?

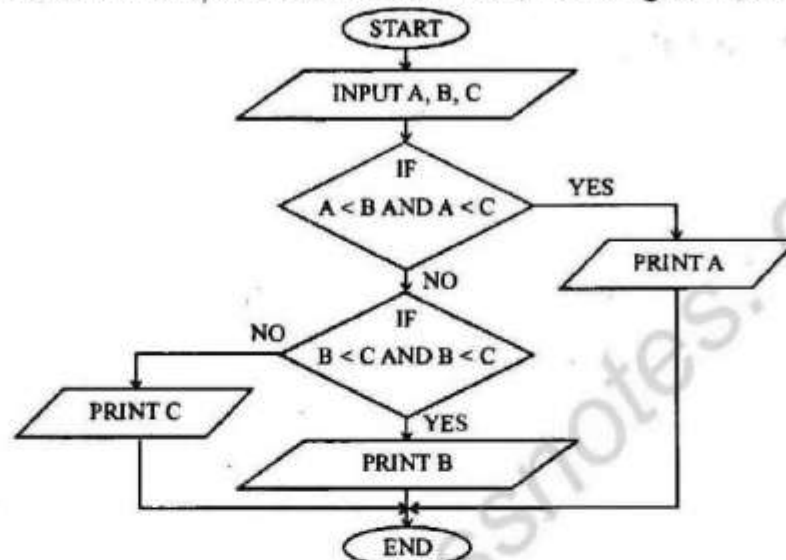
Ans. Conditional flow in flowcharts.

In a conditional flow in flowchart, we study that a flow between steps can depend upon a certain condition. If the condition is true then the flow is different from when the condition is false. A condition is always evaluated as either true or false. For example the following flowchart determines whether a given number is odd or even.

Q.24: Draw a flowchart to find the larger number out of two given numbers.

Ans. Flowchart to find the larger number out of two given numbers.

Q.25: Draw a flowchart to find the smaller number out of two given numbers.

Ans. Flowchart to find the smaller number out of two given numbers.

Q.26: Draw a flowchart to find the largest number out of three given numbers.

Ans. Flowchart to find the largest number out of three given numbers.

Q.27: Draw a flowchart to find the smallest number out of three given numbers.

Ans. Flowchart to find the smallest number out of three given numbers.

Q.28: Draw a flowchart to assign grade to a subject based on total marks and obtained marks.

Ans. Flowchart to assign grade to a subject based on total marks and obtained marks:

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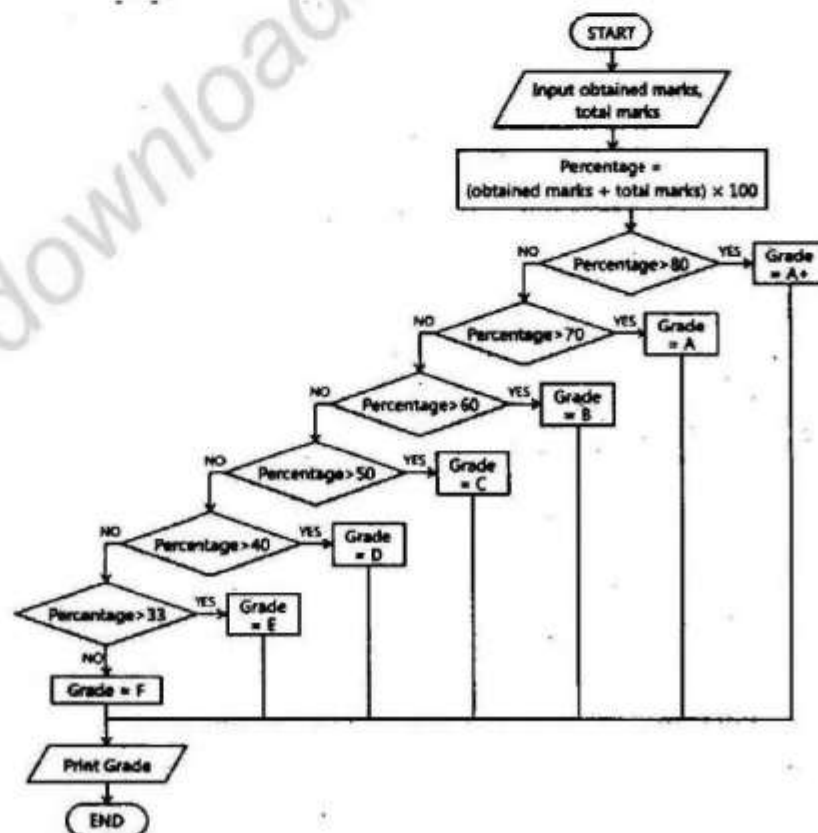
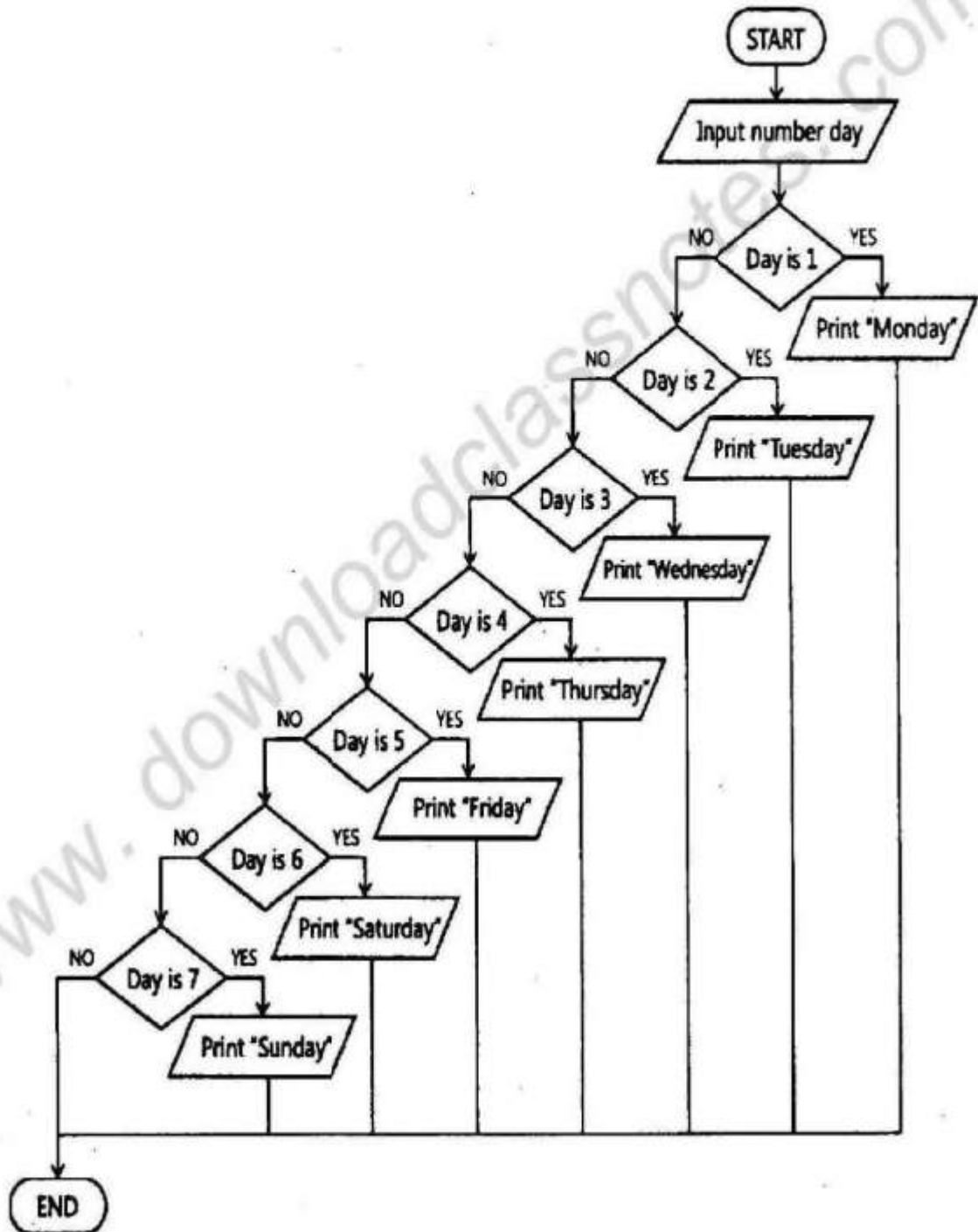
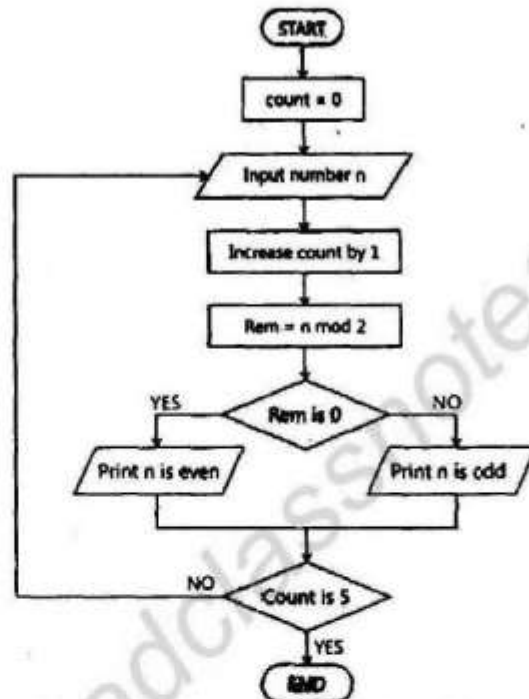
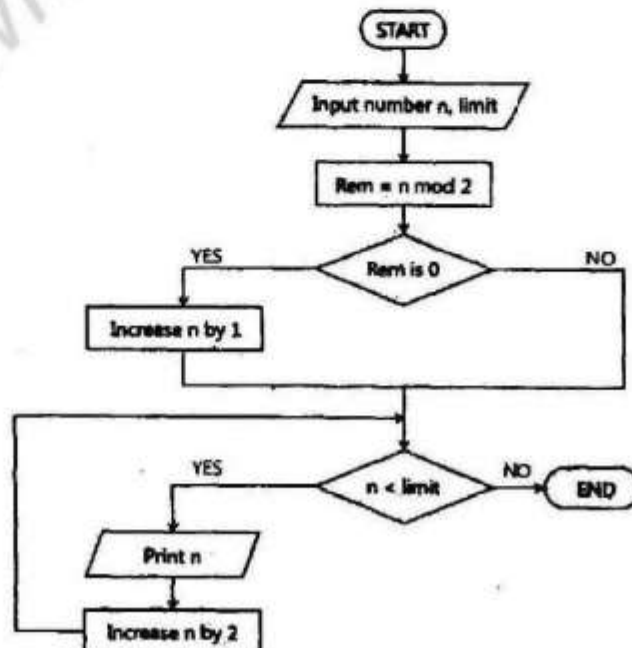
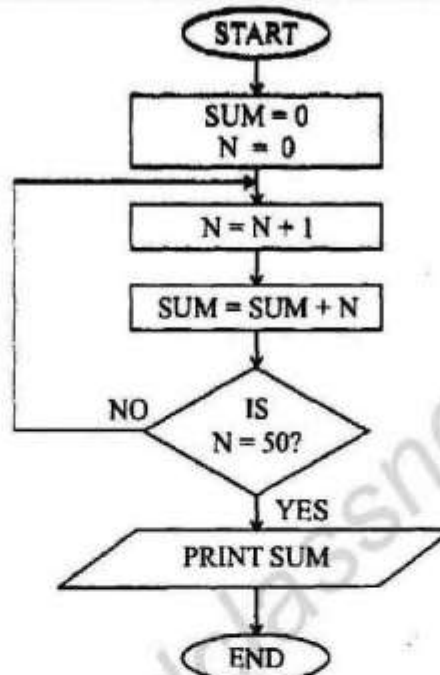

Q.29: Draw a flowchart to determine name of a week day from a given number where weekdays are assumed from Monday to Sunday and their respective numbers from 1 to 7.

Ans. Flowchart

Q.30: Draw a flowchart to input 5 values one by one and determine if the given value is odd or even.

Ans. Flowchart.

Q.31: Draw a flowchart to find a sequence of odd numbers starting from a given number till some limit.

Ans. Flowchart.

Q.32: Draw a flowchart to find the sum of first 50 natural numbers.

Ans. Flowchart to find the sum of first 50 natural numbers.

Q.33: Draw a flowchart to find the factorial of a number.

Ans. Flowchart to find the factorial of a number.

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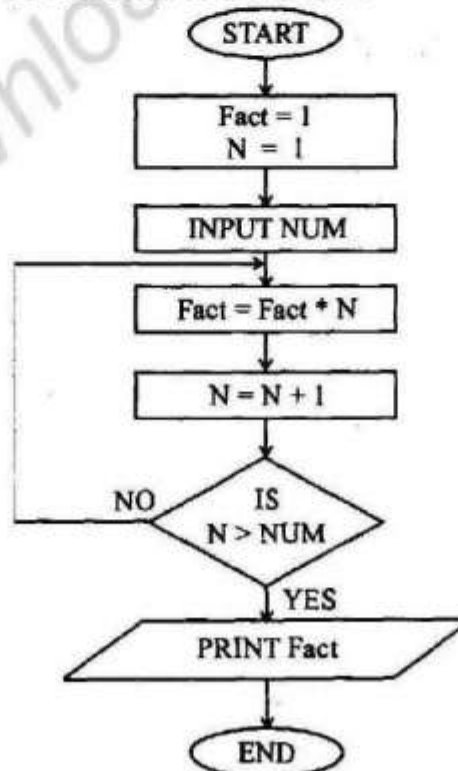
Q.34: Define an algorithm and argue on its role and importance in problem solving.

Ans. Algorithm

An algorithm is a finite set of steps which, if followed, accomplish a particular task. It is a set of steps to solve a problem. An **algorithm must be clear, finite and effective.** It consists of a sequence of numbered steps. It is written in a natural language, so it is easily understandable by humans. For example, to solve the problem of preparing tea, we can follow the following steps:

i. Start
ii. Take a kettle.
iii. Pour water in it.
iv. Put the kettle on fire.
v. Add sugar and milk.
vi. Wait till it boils.
vii. Remove the kettle from fire.
viii. End

The above set of steps can be called an algorithm for tea preparation.

Example 2: Write down the step form algorithm to bake a cake.

Algorithm

i. Heat oven up to 325°F.
ii. Gather the ingredients (Flour, Butter, Sugar, Milk and Eggs).
iii. Mix ingredients thoroughly in a bowl.
iv. Pour the mixture into a baking pan.
v. Bake in the oven for 50 minutes.
vi. Repeat
   Until cake top springs back when touched in the center.
vii. Cool on a rack before cutting.

We can also solve certain problems with the help of a computer. For that purpose, we first formulate an algorithm for the problem and then translate that algorithm into a set of instructions for the computer. Usually an algorithm takes an input and then after processing produces some output.

Role of Algorithm in Problem Solving

An algorithm has a vital role in problem solving as it provides a step by step guide to the problem solver. It is a complete description of the solution. Usually a computer programmer first writes an algorithm and then translates it into the code of some programming language. Sometimes, the designer of the program first makes a flowchart to solve a problem and then encodes the flowchart into an algorithm. Following figure shows the role of an algorithm in problem solving.

Role of Algorithm

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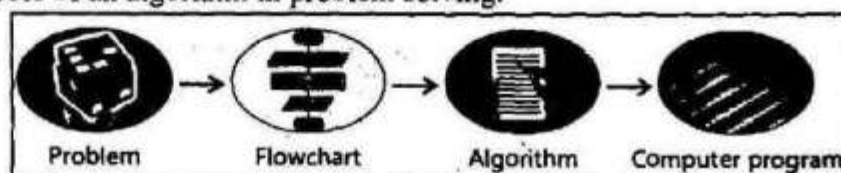
Q.35: What is meant by formulation of an algorithm?

Ans. Formulation of an algorithm

There are different notations (keywords) to write an algorithm. We use the following notations to write an algorithm:

Notations	Meaning
Start	It is the starting point of an algorithm. Every algorithm must have one starting (entry) point.
Input	It is used to get input from a user and store it in computer memory with some name.
Set	It is used to give name to data in computer memory. It is also used to update the value of existing data.
If, else	It is used to check the condition. For example, the condition like if(a<b). A condition is evaluated as true or false. In case the condition is true then the statements related with if part are executed otherwise the statements of else are executed. **Usage:** Suppose a = 5 and b = 7. If (a < 5) Set c to 10 else Set c to 20. Writing else part is optional.
Goto	It is used to transfer control to a certain step of an algorithm. It is usually required in loops.
Output	It is used to display values.
Stop	It is the termination point of an algorithm.

Q.36: Write down an algorithm to find sum, product and average of five given numbers.

Ans. Algorithm

Step1: Start
Step2: Input Numbers, a, b, c, d, e
Step3: Set Sum to a+ b+ c+ d+ e
Step4: Set Product to a× b× c× d× e
Step5: Set Average to Sum/5
Step6: Output Sum, Product, Average
Step7: End

Q.37: Write down an algorithm to calculate the sum and average of given values

Ans. Algorithm:

Step1: Start

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Step2: Set n1 to 25

Step3: Set n2 to 45

Step4: Set n3 to 65

Step5: Set Sum to n1+ n2+ n3

Step6: Set Average to Sum/3

Step7: Output Sum, Average

Step8: End

Q.38: Write down an algorithm to find acceleration of a moving object with given mass and the applied force.

Ans. Algorithm

Step1: Start

Step2: Input Numbers, mass, force

Step3: Set Acceleration to force/mass

Step4: Output Acceleration

Step5: End

Q.39: Write down an algorithm to find the volume of a cube.

Ans. Algorithm

Step1: Start

Step2: Input Number, side

Step3: Set Volume to side× side × side

Step4: Output Volume

Step5: End

Q.40: Write down an algorithm to calculate the volume of a cylinder and sphere.

Ans. Algorithm

Step1: Start

Step2: Input Numbers, Radius, Height

Step3: Set Volume_ Sphere to 4/3 × 3.14× Radius× Radius × Radius

Step4: Set Volume_ Cylinder to 3.14× Radius× Radius × Height

Step5: Output Volume_ Sphere, Volume_ Cylinder

Step6: End

Q.41: Write down an algorithm to find the area of a parallelogram.

Ans. Algorithm

Step1: Start

Step2: Input Numbers, base, height

Step3: Set area to base× height

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Step4: Output area

Step5: End

Q.42: Write down an algorithm to calculate the area of a triangle, rhombus, or trapezium.

Ans. Algorithm

Step1: Start

Step2: Input Numbers, base, height

Step3: Input Numbers, FPS, SFS

Step4: Set area_Triangle to 1/2* base× height

Step5: Set area_Trapezium to ½(FPS+SFS)*height

Step6: Output area_ Triangle, area_Trapezium

Step7: End

Q.43: Write down an algorithm to display the larger one out of the three given numbers.

Ans. Algorithm

Step1: Start

Step2: Input Numbers, a, b, c

Step3: Set large to a

Step4: if b>large Set large to b

Step5: if c>large Set large to c

Step6: Output large

Step7: End

Q.44: Write down an algorithm to assign grade to a subject based on the achieved marks.

Ans. Algorithm

Step1: Start

Step2: Input Numbers, obtained_ marks, total_ marks

Step3: Set percentage to obtained_ marks/ total_ marks× 100

Step4: if percentage> 80 Set grade to A+
else
if percentage> 70 Set grade to A
else
if percentage> 60 Set grade to B
else
if percentage> 50 Set grade to C
else

If percentage> 40 Set grade to D
else
if percentage> 33 Set grade to E
else
Set grade to F

Step5: Output grade

Step6: End

Q.45: Write down an algorithm to find the interest on an amount.

Ans. Algorithm

Step1: Start

Step2: Input Numbers, amount, rate, years

Step3: Set plain_ interest to (amount× rate/100) × years

Step4: Output plain_ interest

Step5: End

Q.46: Write down an algorithm to convert Celsius to Fahrenheit temperature and vice versa.

Ans. Algorithm

Step1: Start

Step2: Input Number, Celsius

Step3: Set Fahrenheit to Celsius× 9/5 + 32

Step4: Output Fahrenheit

Step5: Input Number, Fahrenheit

Step6: Set Celsius to (Fahrenheit-32) × 5/9

Step7: Output Celsius

Step8: End

Q.47: Write down an algorithm to find even numbers in integers ranging from n1 to n2 (where n2 is greater than n1).

Ans. Algorithm

Step1: Start

Step2: Input Numbers, n1, n2

Step3: if (n1≤ n2) {

Step4: if (n1 mod 2 equal 0) Output n1

Step5: Set n1 to n1+ 1

Step6: go to Step 3

}

Step7: End

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Q.48: What is meant by efficiency of an algorithm? How the efficiency of algorithm is measured?

Ans. Efficiency of Algorithm

There can be more than one algorithms to solve the same problem. Which one is better, depends upon the efficiency of the available solution algorithms. Efficiency of an algorithm is measured on the basis of two metrics.

1. Number of Steps:

An algorithm is considered more efficient if it takes less number of steps to reach the results.

2. Space used in computer memory:

We have observed in algorithms that some data is stored in computer memory which is latter used to give results. An algorithm using less space in computer memory is considered more efficient with respect to memory space.

It is quite possible that one algorithm takes less space in memory and has more number of steps whereas the other algorithm takes more memory and has less number of steps. In this case there is trade off between number of steps and the consumed memory. The designer can take decision according to the requirements.

Example 1:

Let's suppose we have two algorithms to solve a certain problem. One algorithm has N steps whereas the other algorithm has N^2 steps. In this case the former algorithm is considered more efficient than the latter one.

Example 2:

We need to compute the following:

$1+2+3+4+5+ \ldots +99$

How can we find its answer?

Different minds can find different solutions to solve this problem. One solution is to start adding numbers from beginning and keep adding till the end. Other solution is to start making pairs as (1+ 99), (2+ 98), (3+ 97), (4+ 96), (5+ 95)... (49 + 51), where each pair gives answer 100. We count the number of pairs and multiply that count with 100 and then in the result we add 50 as it is nowhere in any pair.

Another solution is to use formula $n (n + 1)/2$ where n is the last term. So, the solution is just to solve $99 (99 + 1)/2$.

This example shows different approaches to solve one problem and if these approaches are used in computer then accordingly there may be different memory usage and number of steps.

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Q.49: Differentiate between algorithm and a flowchart.

And. Difference between an Algorithm and a Flowchart.

Flowchart	Algorithm
Block by block information diagram representing the data flow.	Step by step instruction representing the process of any solution.
It is a pictorial representation of a process.	It is step wise analysis of the work to be done.
Solution is shown in graphical format.	Solution is shown in non computer language like English.
Easy to understand as compared to algorithm.	It is somewhat difficult to understand.
Easy to show branching and looping.	Difficult to show branching and looping
Flowchart for big problem is impractical	Algorithm can be written for any problem
Difficult to debug errors.	Easy to debug errors.
It is easy to make flowchart.	It is difficult to write algorithm as compared to flowchart.

Q.50: What are the advantages and disadvantages of an algorithm?

Ans. Advantages of an Algorithm

Some advantages of an algorithm are as follows:

- Easy to write.
- Techniques to write an algorithm are easy to understand.
- To solve a large problem, algorithms are helpful.

Disadvantages of an Algorithm

Some disadvantages of an algorithm are as follows:

- Modifying an existing algorithm is not very easy every time.
- Showing the flow from one step to the other is not very easy.
- Usage of goto makes it difficult to identify errors.

Q.51: What is meant by test data? Explain importance of testing with example.

Ans. Test Data

The data whose results are known in advance is known as test data. After solving the problem, we need to test whether the solution is correct or not, and for testing we need test data. Algorithm is provided a variable set of input for which the output is examined.

Example

For example, if we want to test the algorithm to find the largest number among

three given numbers a, b and c, then we need three values. These values can be positive, negative or zero, e.g. (a=25, b=14, c=23), (a=21, b= 26, c=-5), (a=0, b=10, c=16), etc. So, for thinking about testing, we also need to think about test data.

Importance of Testing

Testing is essential to point out the defects and errors made during finding a solution to some problem. It helps in improving a solution. If one solves a problem and someone else uses that solution for commercial purposes, then the commercial activities depend upon the correctness of that solution. For example, if we develop a solution for finance management and some bank starts using it then any error in that solution may result in a financial loss. So, testing is important for a solution.

Example

A car is delivered to a customer after testing. Upon launching a new car, it is usually tested with a robot driver who hits the car with a wall. It is used to test whether the air bags and other security systems are functioning or not. Moreover, it also allows the car designers to suggest further security measures to reduce the damage. This test can help to make a car safe. So, testing helps to improve quality.

Q.52: Explain types of test data.

Ans. Types of Test Data.

The data whose results are known in advance is known as test data. Creation of proper and sufficient test data is one of the key activities to improve quality of a solution. Each type of solution requires different data. Following are the types of test data:

a) Valid test data

It is the test data that complies with the input requirements of the algorithm. If an algorithm is supposed to take a numeric value between 10 and 1000 as input, then any value between 10 and 1000 is a valid test data.

b) Invalid test data

It is the test data that does not comply with the input requirements of the algorithm. It is necessary to make sure that the solution correctly works for invalid values, shows the relevant messages notifying the user that the provided input values are improper.

c) Boundary test data values

A solution is tested on extreme values. For example, to calculate the pay of the employees we can consider basic salary as 0 or a very huge amount.

d) Wrong data formats

It is wise to check how the system reacts on entering data in an inappropriate format. For example, giving an alphabet as input when a numeric value is expected.

e) Absent data

It is also important to investigate that the solution still works if less number of

inputs are given than expected. For example, if a system asks to enter driving license number, then every one cannot provides this information. It is important to see how the system reacts in such situations.

Q.53: Explain verification and validation with example.

Ans. Verification

Verification means to test if the solution is actually solving the same problem for which it was designed. For example, if you are asked to give a solution for calculating compound interest then verification means to know that it is giving results for compound interest not for the plain interest.

Validation

Validation means to test whether the solution is correct or not. For example, if you are asked to give a solution for calculating compound interest then validation means to know whether it is finding the correct compound interest or not. If a solution is verified, then it is validated with the help of test data.

Example

Let's assume that you are asked to write an algorithm that takes as input a list of numbers. The algorithm should display the list arranged in ascending order. After writing the algorithm you submit it to your teacher. Your teacher provides a list of numbers to the algorithm. If your algorithm displays a list of numbers then it is verified. Instead if your algorithm displays an answer in yes or no, or displays something else, then it is not verified. If your algorithm is verified, your teacher moves to the next step of validation. He checks whether the list of numbers displayed are actually in ascending order or not. If the list is in ascending order and no element is missing then your solution is also validated.

Q.54: What is meant by identification and correction of errors?

Ans. Identification and Correction of Errors

Finding and removing errors from the solution of the problem is called debugging. If an algorithm is failed during verification process, then it is important to identify the root cause of failure and then to correct it. Sometimes the error is logical. It means the solution is working but not giving required results.

Example

For example, to select students for cricket team of school, we need students having height 135 cm and 155 cm. To count qualified students, we develop the following algorithm.

Algorithm

Step1: Start
Step2: Set count to 0
Step3: Set all_ heights to [135, 139, 140, 155, 144, 150, 149, 153]
Step4: For each height in the list all_ heights
Step5: if height > 135 and height ≤ 155 then set count to count + 1
Step6: output count
Step7: End

The above algorithm works but does not count all students. There is a deliberate error on step 5. The symbol > has been used instead of ≥ before the number 135. So, the students having height 135cm will not be counted. This is a logical error. We can identify this type of errors using a trace table.

Q.55: Describe a trace table.

Ans. Trace Table

A technique used to test algorithms in order to make sure that no logical errors occur while the algorithm is being processed is called a trace table. The table usually takes the form of a multi-column, multi-row table, with each column showing names of data and each row showing values of the data at each step. Following table shows a trace table for the algorithm to select students for cricket team of school, for the students having height 135 cm and 155 cm.

Step1: Start
Step2: Set count to 0
Step3: Set all_ heights to [135, 139, 140, 155, 144, 150, 149, 153]
Step4: For each height in the list all_ heights
Step5: if height > 135 and height ≤ 155 then set count to count + 1
Step6: output count
Step7: End

The blank means there is no change and -- means that a value is not concerned. In the following table Step 1 has no effect on data. Step 2 is assigning 0 to count and in Step 3, list all_ heights is introduced. In Step 4, there is no change in both count and all_ heights but the data 135 is stored in height. It is compared in Step 5 and the value in count is updated if data is in given range. Steps 4 and 5 are repeated for each value as shown in the given table.

	Count	all_heights	height
Step1	--	--	--
Step 2	0	--	--
Step 3		[135, 139, 140, 155, 144, 150, 149, 153]	
Step 4			135
Step 5	1		
Step 4			139
Step 5	1		
Step 4			140
Step 5	2		
Step 4			155
Step 5	3		
Step 4			144
Step 5	3		
Step 4			150
Step 5	4		
Step 4			149
Step 5	5		
Step 4			153
Step 5	5		
Step 6			
Step 7			

Q.56: What is the purpose of using invalid data for testing?

Ans. Using Invalid Data for Testing

Testing an algorithm using invalid data ensures that the algorithm can gracefully handle unexpected data inputs. If an algorithm requires your age in number of days but you give date of birth as input then the algorithm may not work properly. The purpose of testing using invalid test data is to detect such situations. In this case error messages are shown as output. Moreover, this kind of testing helps you to improve the quality of solution.

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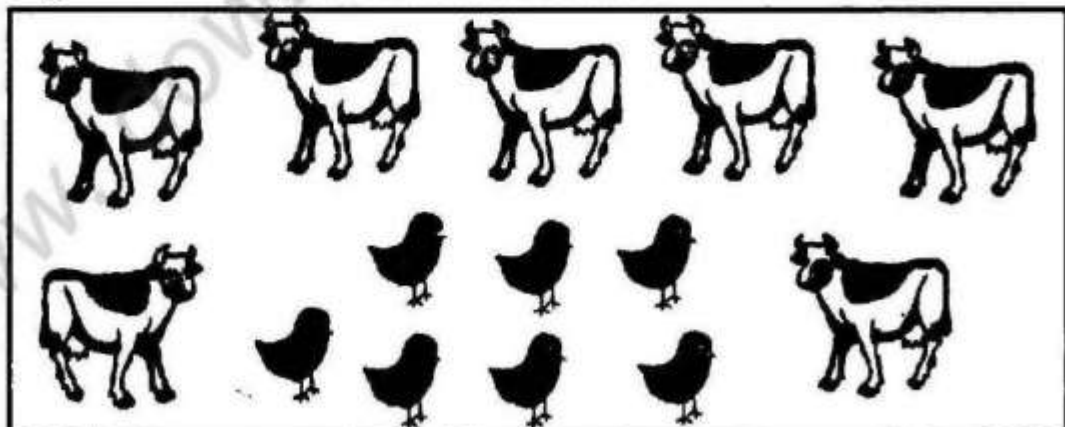
SUMMARY

- A problem is a matter or situation needs to be dealt with and overcome.
- Analysing a problem helps to solve that problem quickly.
- A problem may have more than one solution but the best one is the solution comprising less number of steps or the solution is achieved in less amount of time.
- An algorithm is a set of rules used for solving problems.
- An algorithm takes some input, processes it and gives result.
- Algorithms are helpful in decision making.
- Flowcharts consist of symbols used for graphical presentation of an algorithm.
- Commonly used symbols for a flowchart are: input/output, decision, arrow, start and stop.
- Validation means to test if the solution is according to given problem.
- Verification means whether the solution is giving the required results or not.
- A trace table is a technique used to test algorithms.

SOLVED EXERCISE

1.1 Answer the following questions.

1. In a farm there are some cows and birds. If there are total 35 heads and 110 legs then how many cows and birds are there?

Ans. It there are total 35 heads and 110 legs then there are 20 cows and 15 birds in the farm. As each cow has four legs and each bird has two legs.

2. Define problem analysis. Explain your answer along with an example.

Ans. See question no. 2

3. **Define an algorithm and argue on its role and importance in problem solving.**

Ans. See question no. 34

4. **Suppose a problem has multiple algorithms. How would you choose the most efficient one? Explain with examples.**

Ans. See question no. 48

5. **How do you determine requirements for a flowchart?**

Ans. See question no. 7

6. **Explain types of test data.**

Ans. See question no. 52

7. **Describe a trace table.**

Ans. See question no. 55

1.2 Choose the correct option.

1. **Which solutions are not reached through proper algorithms or work planning?**
   (i) Prepared solution (ii) Candid solution
   (iii) strategized solution (iv) best solution
2. **________ is a graphical representation of an algorithm.**
   (i) Matrix (ii) Graph (iii) Flowchart (iv) solution
3. **Which symbol in the flowchart is used to either start or end the flowchart?**
   (i) Terminal (ii) Connector (iii) Process (iv) decision
4. **________ means to test if the required solution is there.**
   (i) Verification (ii) Algorithm (iii) Validation (iv) Flowchart
5. **In a _______ error, the solution is working but not giving required results.**
   (i) Random error (ii) logical error (iii) syntax error (iv) Runtime error

Answers:

1. Candid solution 2. Flowchart 3. Terminal
4. Verification 5. logical error

1.3 Fill in the blanks.

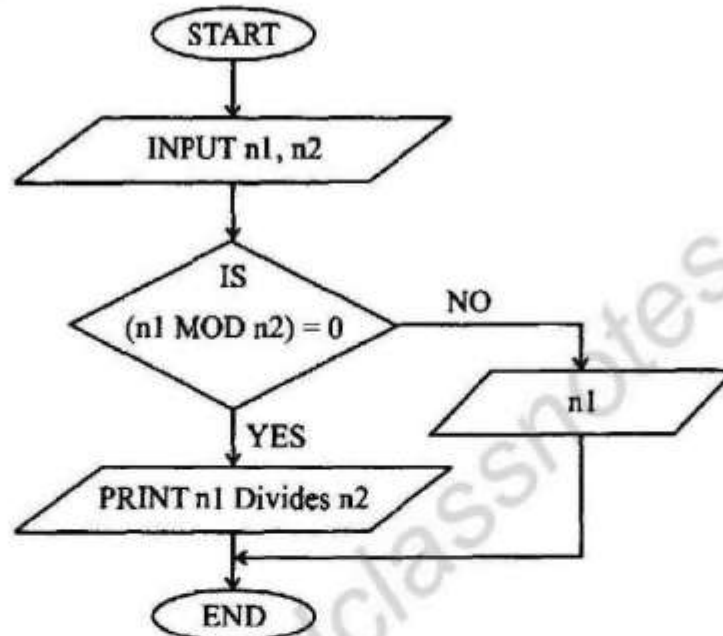
1. Before problem solving, we need to first ________ a problem.
2. An algorithm produces a defined set of ________.
3. A flowchart utilizes various ________ and ________ to map out the order of steps.
4. In flowcharts symbol ◇ is used to show a ________.
5. ________ is used to test the solutions.

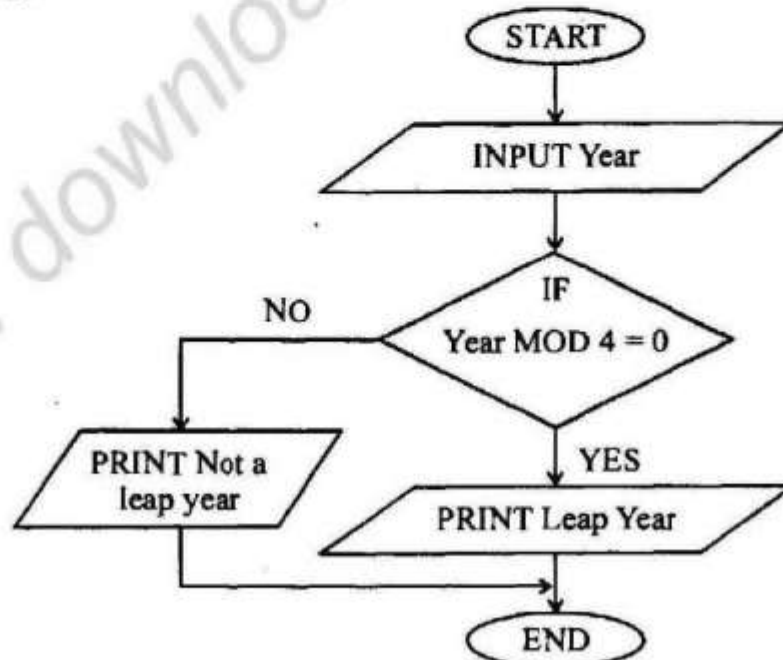
Answers:

1. Analyse 2. Steps 3. Symbols, Text
4. Decision Making 5. Verification

1.4 Draw the flowcharts for the following problems.

1. Input two numbers n1 and n2. Determine whether n1 divides n2 or not.

Ans. Flowchart

2. Input a year and determine whether it is a leap year or not.

Ans. Flowchart

3. Input a number and calculate its factorial.

Ans. See question no. 33

4. Find LCM (Lease Common Multiple) of two numbers.

Ans. Flowchart

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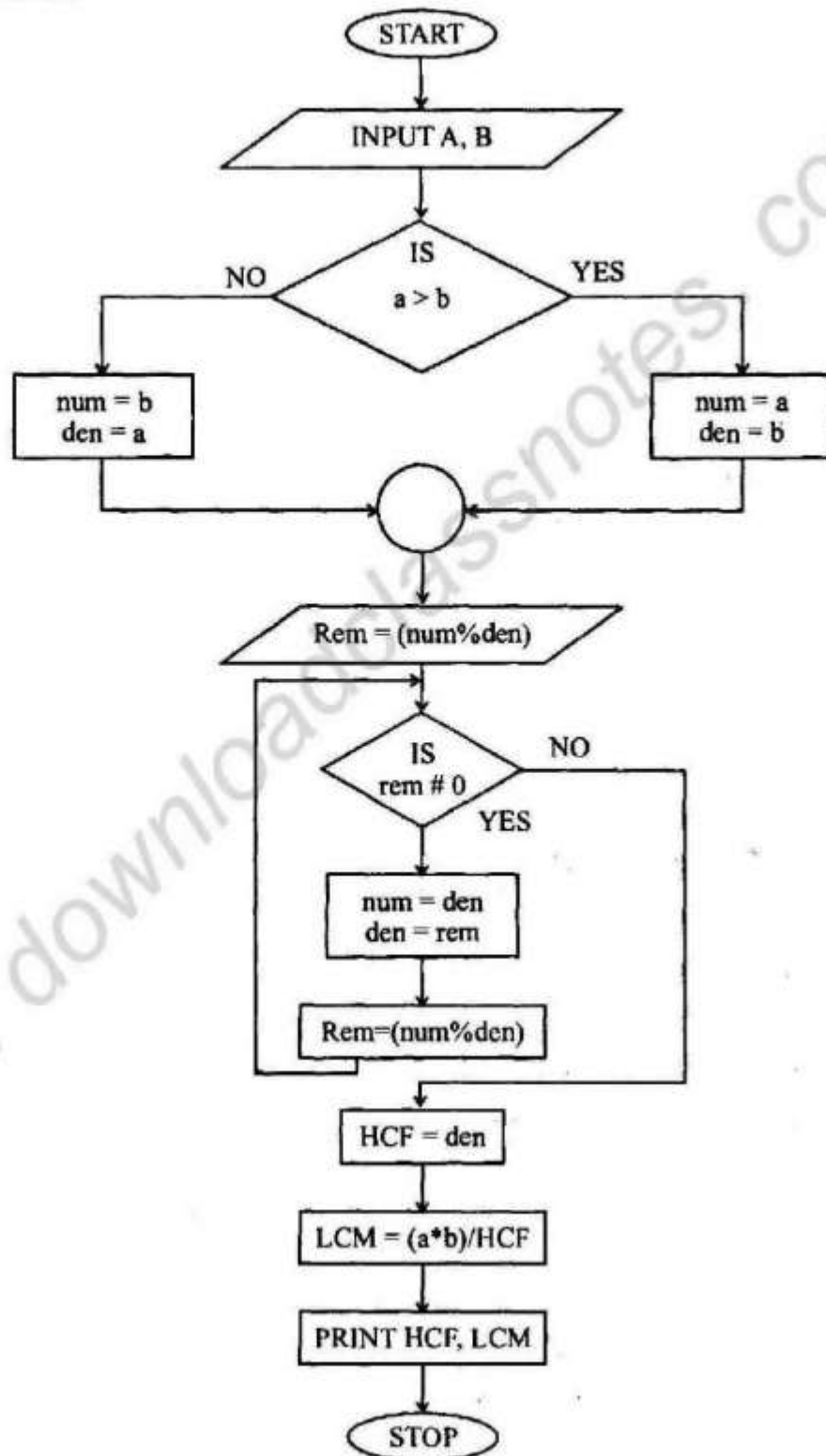
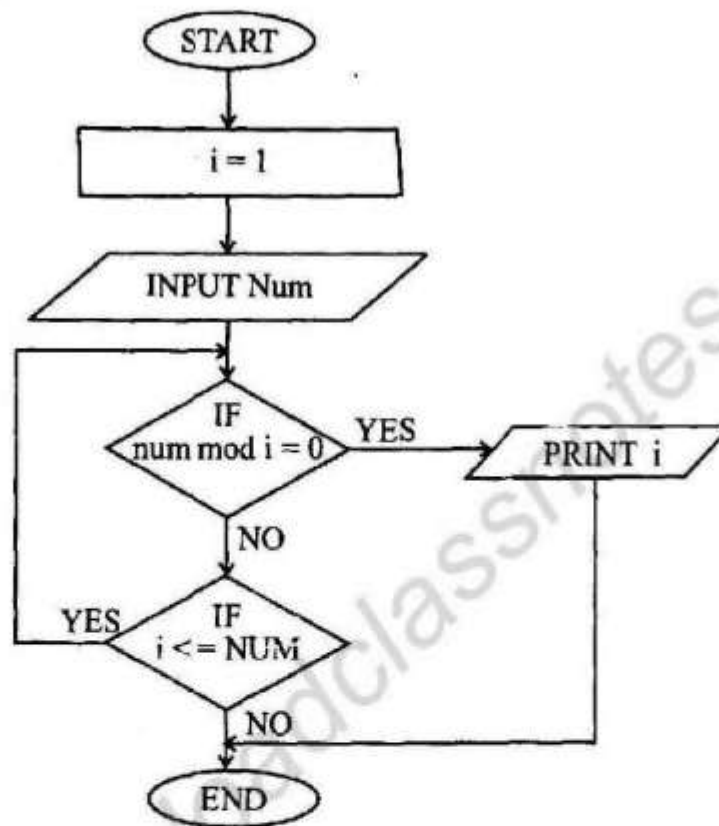

5. Input a number and display its factors.

Ans. Flowchart

Objective Type Questions

- **Choose the correct answer:**

1. Which of the following is a matter or situation needs to be dealt with and overcome?

(a) Problem (b) Algorithm (c) Flowchart (d) Trace Table

2. Which of the following is a skill to approach the solution of a given problem?

(a) Problem (b) Algorithm (c) Flowchart (d) Problem Solving

3. _____________ a problem helps to solve that problem quickly.

(a) Defining (b) Analyzing (c) Understanding (d) Algorithm

4. In this stage the problem being solved is observed carefully.

(a) Defining (b) Coding (c) Testing (d) Analysis

5. This phase includes finding the right strategy for problem solving.

(a) Testing (b) Coding (c) Planning (d) Analysis

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6. **_________ Strategy divides a complex problem into smaller problems.**
   (a) Divide and Conquer (b) Prototype
   (c) Act it Out (d) Guess
7. **In this strategy the designer defines the list of "to-do" tasks.**
   (a) Divide and Conquer (b) Prototype
   (c) Act it Out (d) Guess
8. **This technique draws a pictorial representation of the solution.**
   (a) Divide and Conquer (b) Prototype .
   (c) Act it Out (d) Guess
9. **It may help a designer to understand the important components of the solution.**
   (a) Divide and Conquer (b) Prototype
   (c) Act it Out (d) Guess
10. **The word __________ refers to something spontaneous and unplanned.**
    (a) Candid (b) Coding (c) Testing (d) Analysis
11. **In flowcharts diamond symbol is used to show:**
    (a) Input (b) Process (c) Output (d) Decision
12. **In flowcharts rectangle symbol is used to show:**
    (a) Input (b) Process (c) Output (d) Decision
13. **In flowcharts parallelogram symbol is used to show:**
    (a) Input (b) Output (c) Both (a) & (b) (d) Decision
14. **The ___________ steps are used for performing calculations and storing the results of calculations.**
    (a) Input (b) Processing (c) Output (d) Decision
15. **Most widely used symbols in flowcharts are:**
    (a) Terminal (b) Flow Lines (c) Connector (d) All of These
16. **_________ are used to determine the flow of steps in a flowchart.**
    (a) Terminal (b) Flow Lines (c) Connector (d) All of These
17. **___________ are represented by arrowheads.**
    (a) Terminal (b) Flow Lines (c) Connector (d) Decision
18. **Symbol is used to represent the start and end of the flow chart.**
    (a) Terminal (b) Flow Lines (c) Connector (d) Decision
19. **It is represented by an oval shape.**
    (a) Terminal (b) Flow Lines (c) Connector (d) Decision

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20. It is used in a flowchart to represent the arithmetic operations and data movement instructions.

(a) Oval Symbol (b) Flow Lines
(c) Connector (d) Rectangle Symbol

21. It shows a conditional operation that determines which one of the two paths to take.

(a) Terminal (b) Flow Lines (c) Connector (d) Decision

22. This is the only symbol which has more than one exit point.

(a) Terminal (b) Flow Lines (c) Connector (d) Decision

23. We use __________ to connect parts of a flowchart on different pages.

(a) Terminal (b) Flow Lines (c) Connector (d) Decision

24. An ____________ is a set of rules used for solving problems.

(a) Problem (b) Trace Table (c) Flowchart (d) Algorithm

25. An algorithm performs tasks:

(a) Input (b) Process (c) Output (d) All of these

26. Which of the following are helpful in decision making?

(a) Flowchart (b) Trace Table (c) Algorithm (d) None of these

27. Commonly used symbols for a flowchart are:

(a) Input/ Output (b) Process (c) Decision (d) All of these

28. In an algorithm, it is used to give name to data in computer memory.

(a) Start Notation (b) Input Notation (c) Set Notation (d) If, else Notation

29. In an algorithm, it is used to update the value of existing data.

(a) Start Notation (b) Input Notation (c) Set Notation (d) If, else Notation

30. In an algorithm, it is used to check the condition.

(a) Start Notation (b) Input Notation (c) Set Notation (d) If, else Notation

31. In an algorithm, it is usually required in loops.

(a) Start Notation (b) Go to Notation (c) Set Notation (d) If, else Notation

32. ________ is the termination point of an algorithm.

(a) Stop Notation (b) Go to Notation (c) Set Notation (d) If, else Notation

33. The data whose results are known in advance is known as:

(a) Test data (b) Algorithm Data (c) Normal Data (d) Abnormal data

34. Types of test data:

(a) Valid Test data (b) Invalid test Data
(c) Absent Data (d) All of these

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35. It is the test data that complies with the input requirements of the algorithm.

(a) Valid Test data (b) Invalid test Data
(c) Absent Data (d) All of these

36. It is the test data that does not comply with the input requirements of the algorithm.

(a) Valid Test data (b) Invalid test Data
(c) Absent Data (d) All of these

37. __________ means to test if the solution is actually solving the same problem for which it was designed.

(a) Verification (b) Validation (c) Decision (d) Testing

38. _________ means to test if the solution is according to given problem.

(a) Verification (b) Validation (c) Decision (d) Testing

39. Finding and removing errors from the solution of the problem is called:

(a) Bug (b) Trace Table (c) Debugging (d) Validation

40. Program errors are called:

(a) Bugs (b) Trace Table (c) Debugging (d) Validation

41. Types of program errors:

(a) Syntax Errors (b) Logical Errors (c) Runtime Errors (d) All of these

42. Error occurs when the program violates one or more grammatical rules of the programming language are known as:

(a) Syntax Errors (b) Logical Errors (c) Runtime Errors (d) Mix errors

43. This type of error occurs when a program follows a wrong logic.

(a) Syntax Errors (b) Logical Errors (c) Runtime Errors (d) Mix errors

44. Dividing a number by zero is:

(a) Syntax Errors (b) Logical Errors (c) Runtime Errors (d) Mix errors

45. Which of the following is a technique used to test algorithms?

(a) Flowchart (b) Trace Table (c) Algorithm (d) Validation

Answers:

1. Problem	**2.** Problem Solving		**3.** Analyzing
4. Analysis	**5.** Planning	**6.** Divide and Conquer	
7. Act it Out	**8.** Prototype	**9.** Prototype	**10.** Candid
11. Decision	**12.** Process	**13.** Both (a) & (b)	**14.** Processing
15. All of These	**16.** Flow Lines	**17.** Flow Lines	**18.** Terminal

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19. Terminal **20.** Rectangle Symbol **21.** Decision
22. Decision **23.** Connector **24.** Algorithm **25.** All of these
26. Algorithm **27.** All of these **28.** Set Notation **29.** Set Notation
30. If, else Notation **31.** Go to Notation **32.** Stop Notation
33. Test data **34.** All of these **35.** Valid Test data **36.** Invalid test Data
37. Verification **38.** Validation **39.** Debugging **40.** Bugs
41. All of these **42.** Syntax Errors **43.** Logical Errors
44. Runtime Errors **45.** Trace Table

- **Give Short Answers:**

1. Define problem.

Ans. Problem: A problem is a hurdle which needs to be removed. A problem is a matter or situation needs to be dealt with and overcome.

2. Define problem solving.

Ans. Problem Solving: Problem solving is a skill to approach the solution of a given problem and it can be developed by following a well organized approach.

3. What is meant by a well defined problem?

Ans. A well defined problem is the one that does not contain ambiguities. All the conditions are clearly specified and it has a clear goal. It is easy to understand and solve.

4. Write down strategies steps to define a problem.

Ans. Strategies to define the Problem: If the problem is not defined well then we can use one of the following strategies to define the problem:

☆ Gain Background Knowledge ☆ Use Guesses ☆ Draw a Picture

5. Define problem analysis.

Ans. Problem Analysis: It is important to understand the problem before jumping into the solution of the problem. A clear understanding of a problem makes it easier to solve and helps to save money, time and resources. In this stage the problem being solved is observed carefully. Major areas of concern are identified and irrelevant information is filtered out.

6. What is meant by planning a solution?

Ans. Planning a Solution: After analyzing a problem, we formulate a plan that may lead us towards the solution of a problem. This phase includes finding the right strategy for problem solving.

7. Write down different strategies for planning a solution.

Ans. Strategies for Planning a Solution: Different strategies for planning a solution are as follows:

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☆ Divide and Conquer
☆ Guess, Check and Improve
☆ Act it Out
☆ Prototype (Draw)

8. What is meant by divide and conquer strategy?

Ans. Divide and Conquer Strategy: Divide and Conquer Strategy divides a complex problem into smaller problems.

9. What is meant by Guess, Check and Improve

Ans. Guess, Check and Improve: The designer guesses a solution to a problem and then checks the correctness of the solution. If the solution is not according to expectations, then he/she refines the solution. The refinement is an iterative process.

10. What is meant by Act it Out strategy?

Ans. Act it Out Strategy: In this strategy the designer defines the list of "to-do" tasks. Afterwards he/she performs the task.

11. What is meant by Prototype (Draw) technique?

Ans. Prototype (Draw): This technique draws a pictorial representation of the solution. It is not the final solution. However, it may help a designer to understand the important components of the solution.

12. On what factor the selection of the strategy depends?

Ans. The selection of the strategy depends upon the problem. It is quite important that one strategy maybe more suitable to implement a solution than the other one. Very specifically, the selection of the strategy depends upon the nature of a problem.

13. What is meant by defining candid solutions?

Ans. Candid Solutions: The word candid refers to something spontaneous and unplanned. For example, if you are asked to find number of students in your school who can play cricket. You can estimate by finding cricket players in your class and then multiplying it by the total number of classes in your school. Your answer in this way is the candid solution.

14. What is meant by selecting the best solution?

Ans. Selecting the Best Solution: Sometimes we find more than one solutions of a problem and select the best one amongst them. For example, assume that names of all the students in your school are available on a website and you are asked to search a particular name.

15. What is a flowchart?

Ans. Flowchart: Pictorial representation of an algorithm is called a flowchart. It is a graphical representation of these steps to solve a problem. We use symbols for each step and these symbols are connected with the help of arrows to show the flow of

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processing. Flowchart is a way of visually presenting the flow of data, the operations performed within the system and the sequence in which they are performed. Flowcharts are helpful to know about the steps to solve a problem.

16. Write down the importance of flowchart.

Ans. Importance of Flowcharts in Problem Solving:

- ☆ In problem solving process, flowcharts can be used to plan a solution.
- ☆ If flowchart is already there, we can quickly understand the way a problem is solved.
- ☆ It is more effective to visualize a solution graphically than a text.

17. How do you determine requirements for a flowchart?

Ans. Determining Requirements for a Flowchart: In a flowchart we use input, output, decision making and processing. These concepts must be clear before drawing a flowchart.

18. What is the use of inputs in a flowchart?

Ans. Inputs: Input means taking data from the user. It is important to know, how many and what type of inputs are required.

19. What is the use of processing in a flowchart?

Ans. Processing: A flowchart also contains processing steps. The processing steps are used for performing calculations and storing the results of calculations. These may include increasing/decreasing a value adding/ multiplying/ dividing two values etc.

20. What is the use of decision making in a flowchart?

Ans. Decision Making: To determine whether a statement is true or false, and taking appropriate steps accordingly, is called decision making.

21. What is the use of outputs in a flowchart?

Ans. Outputs: Outputs are used to display information and usually this information exhibits the processed results.

22. What is the use of different symbol of flowchart?

Ans. Symbols of Flowchart: Flowcharts explain a process clearly through symbols and text. They are usually drawn using some standard symbols. Flowcharts use special shapes to represent different types of actions or steps in a process.

23. Write down some of the most widely used symbols in flowcharts.

Ans. Some of the most widely used symbols in flowcharts are as follows:

- ☆ Flow Lines
- ☆ Terminal symbol
- ☆ The Processing symbol
- ☆ The Input/output symbol
- ☆ The Decision symbol
- ☆ Connector symbol

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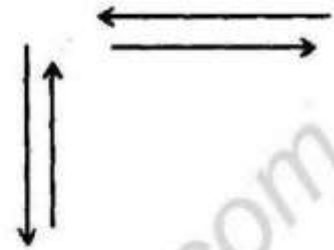
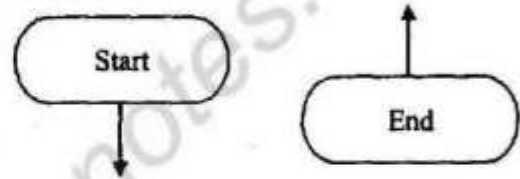
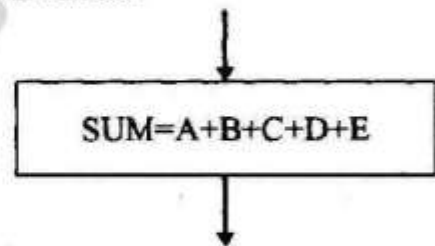
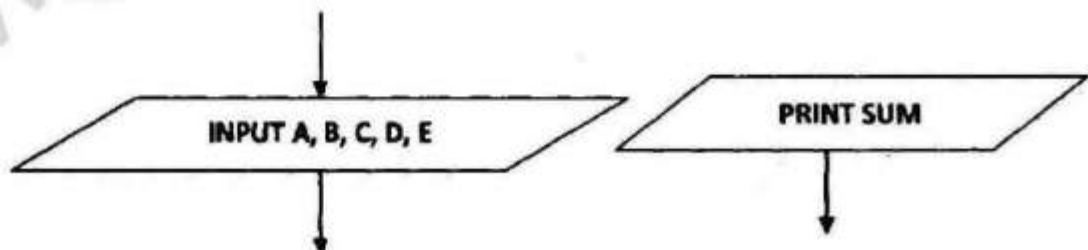
24. What is the use of flow lines in a flowchart?

Ans. Flow Lines: Flow Lines are used to determine the flow of steps in a flowchart. We read a flowchart by following the flow lines. A flow line represents a connecting path between flowchart symbols. Flow lines are represented by arrowheads. They are used to show the direction of movement of instructions in a flowchart.

25. What is the use of terminal symbol in a flowchart?

Ans. Terminal Symbol: Terminal Symbol is used to represent the start and end of the flow chart. It is represented by an oval shape. Normally every flowchart starts and ends with this symbol.

26. What is the use of processing symbol in a flowchart?

Ans. The Processing symbol: The rectangle symbol used in flowchart is the process symbol. It is used in a flowchart to represent the arithmetic operations and data movement instructions. It represents operations to change values.

27. What is the use of Input/output symbol in a flowchart?

Ans. The Input/output symbol: Problem solving may involve data processing. We get the data, do some calculation and produce the result. In a flowchart, we use parallelogram symbol for input and output. The input symbol is used to mark the point at which we put in data and the output symbol is used to mark the point at which we get the result. It indicates the input of data from user or displaying results to user.

28. What is the use of decision symbol in a flowchart?

Ans. The Decision symbol: There may be a point in our flowchart where the flow lines branch out. At this point we have to decide which way to go. In a flowchart, we use

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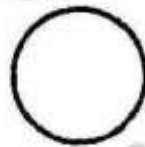
a diamond shaped symbol called the decision symbol. It shows a conditional operation that determines which one of the two paths to take. The operation is commonly a yes/no question or a true/ false test. This is the only symbol which has more than one exit point.

29. What is the use of connector symbol in a flowchart?

Ans. Connector: If a flowchart does not fit on a page, then we use connector to connect parts of a flowchart on different pages.

30. Write down the advantages of a flowchart.

Ans. Advantages of a Flowchart: Some advantages of flowcharts are as follows:

- ☆ Easy to draw.
- ☆ Easy to understand problem solving,
- ☆ It helps in debugging process.
- ☆ Easy to observe flow from one step to the other.

31. Write down the disadvantages of a flowchart.

Ans. Disadvantages of a Flowchart: Some disadvantages/limitations of flowcharts are as follows:

- ☆ More time is required to draw a flowchart.
- ☆ Modifying a flowchart is not very easy every time.
- ☆ It is not suitable for very large and complex problems.

32. What is meant by conditional flow in flowcharts?

Ans. Conditional flow in flowcharts: In a conditional flow in flowchart, we study that a flow between steps can depend upon a certain condition. If the condition is true then the flow is different from when the condition is false. A condition is always evaluated as either true or false.

33. Define an algorithm and argue on its role and importance in problem solving.

Ans. Algorithm: An algorithm is a finite set of steps which, if followed, accomplish a particular task. It is a set of steps to solve a problem. An algorithm must be clear, finite and effective. It consists of a sequence of numbered steps. It is written in a natural language, so it is easily understandable by humans.

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34. Write down an algorithm for preparing tea.

Ans. Algorithm:

i. Start **ii.** Take a kettle. **iii.** Pour water in it.

iv. Put the kettle on fire. **v.** Add sugar and milk.

vi. Wait till it boils. Remove the kettle from fire.

vii. Pour tea from kettle into cup. **viii.** End

35. What is the role of Algorithm in Problem Solving.

Ans. Role of Algorithm in Problem Solving: An algorithm has a vital role in problem solving as it provides a step by step guide to the problem solver. It is a complete description of the solution. Usually a computer programmer first writes an algorithm and then translates it into the code of some programming language. Sometimes, the designer of the program first makes a flowchart to solve a problem and then encodes the flowchart into an algorithm.

36. What is the use of start notation in an algorithm?

Ans. Start Notation: It is the starting point of an algorithm. Every algorithm must have one starting (entry) point.

37. What is the use of Input notation in an algorithm?

Ans. Input Notation: It is used to get input from a user and store it in computer memory with some name.

38. What is the use of Set notation in an algorithm?

Ans. Set Notation: It is used to give name to data in computer memory. It is also used to update the value of existing data.

39. What is the use of If, else notation in an algorithm?

Ans. If, else Notation: It is used to check the condition. For example the condition like if (a < b). A condition is evaluated as true or false. In case the condition is true then the statements related with if part are executed otherwise the statements of else are executed.

Usage:

Suppose a = 5 and b = 7.

If (a < 5) Set c to 10 else Set c to 20.

Writing else part is optional.

40. What is the use of goto notation in an algorithm?

Ans. Goto Notation: It is used to transfer control to a certain step of an algorithm. It is usually required in loops.

41. What is the use of output notation in an algorithm?

Ans. Output notation is used to display values.

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42. What is the use of stop notation in an algorithm?

Ans. Stop notation is the termination point of an algorithm.

43. How the efficiency of algorithm is measured?

Ans. Efficiency of Algorithm: There can be more than one algorithms to solve the same problem. Which one is better, depends upon the efficiency of the available solution algorithms. Efficiency of an algorithm is measured on the basis of two metrics.

- ☆ Number of Steps
- ☆ Space used in computer memory

44. What are the advantages of an algorithm?

Ans. Advantages of an Algorithm: Some advantages of an algorithm are as follows:

- ☆ Easy to write.
- ☆ Techniques to write an algorithm are easy to understand.
- ☆ To solve a large problem, algorithms are helpful.

45. What are the disadvantages of an algorithm?

Ans. Disadvantages of an Algorithm: Some disadvantages of an algorithm are as follows:

- ☆ Modifying an existing algorithm is not very easy every time.
- ☆ Showing the flow from one step to the other is not very easy.
- ☆ Usage of goto makes it difficult to identify errors.

46. Define test data?

Ans. Test Data: The data whose results are known in advance is known as test data. After solving the problem, we need to test whether the solution is correct or not, and for testing we need test data. Algorithm is provided a variable set of input for which the output is examined.

47. Write down the Importance of Testing.

Ans. Importance of Testing: Testing is essential to point out the defects and errors made during finding a solution to some problem. It helps in improving a solution. If one solve a problem and someone else uses that solution for commercial purposes, then the commercial activities depend upon the correctness of that solution.

48. Write down different types of test data.

Ans. Types of Test Data: Following are the types of test data:

- ☆ Valid test data
- ☆ Invalid test data
- ☆ Boundary test data values
- ☆ Wrong data formats
- ☆ Absent data

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49. What is meant by valid test data?

Ans. Valid test data: It is the test data that complies with the input requirements of the algorithm. If an algorithm is suppose to take a numeric value between 10 and 1000 as input, then any value between 10 and 1000 is a valid test data.

50. What is meant by invalid test data?

Ans. Invalid test data: It is the test data that does not comply with the input requirements of the algorithm. It is necessary to make sure that the solution correctly works for invalid values, shows the relevant messages notifying the user that the provided input values are Improper.

51. What is meant by boundary test data values?

Ans. Boundary test data values: A solution is tested on extreme values. For example, to calculate the pay of the employees we can consider basic salary as 0 or a very huge amount.

52. What is meant by wrong data formats?

Ans. Wrong data formats: It is wise to check how the system reacts on entering data in an inappropriate format. For example, giving an alphabet as input when a numeric value is expected.

53. What is meant by absent data?

Ans. Absent data: It is also important to investigate that the solution still works if less number of inputs are given than expected. For example, if a system asks to enter driving license number, then every one cannot provides this information. It is important to see how the system reacts in such situations.

54. What is meant by verification?

Ans. Verification: Verification means to test if the solution is actually solving the same problem for which it was designed. For example, if you are asked to give a solution for calculating compound interest then verification means to know that it is giving results for compound interest not for the plain interest.

55. What is meant by validation?

Ans. Validation: Validation means to test whether the solution is correct or not. For example, if you are asked to give a solution for calculating compound interest then validation means to know whether it is finding the correct compound interest or not. If a solution is verified, then it is validated with the help of test data.

56. What is meant by identification and correction of error?

Ans. Identification and Correction of Errors: Finding and removing errors from the solution of the problem is called debugging. If an algorithm is failed during verification process, then it is important to identify the root cause of failure and

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then to correct it. Sometimes the error is logical. It means the solution is working but not giving required results.

57. Define bug.

Ans. Bug: Program errors are called bug.

58. Define debugging.

Ans. Debugging: Process of finding and removing errors from the program is called debugging.

59. What are the types of program errors?

Ans. Types of program errors: There are three types of program errors:

☆ Syntax errors ☆ Logical errors ☆ Runtime errors

60. Define syntax errors.

Ans. Syntax Errors: Error occurs when the program violates one or more grammatical rules of the programming language are known as syntax errors.

61. Define logical errors.

Ans. Logical Errors: The error occurs due to the wrong logic of the program are known as logical errors. These errors are difficult to find.

62. Define runtime errors.

Ans. Runtime Errors: These errors occur when the computer program performs an illogical operation. E.g. dividing a number by zero.

63. Define a trace table.

Ans. Trace Table: A technique used to test algorithms in order to make sure that no logical errors occur while the algorithm is being processed is called a trace table. The table usually takes the form of a multi-column, multi-row table, with each column showing names of data and each row showing values of the data at each step.

64. What is the purpose of using invalid data for testing?

Ans. Using Invalid Data for Testing: Testing an algorithm using invalid data ensures that the algorithm can gracefully handle unexpected data inputs. If an algorithm requires your age in number of days but you give date of birth as input then the algorithm may not work properly. The purpose of testing using invalid test data is to detect such situations. In this case error messages are shown as output. Moreover, this kind of testing helps you to improve the quality of solution.

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UNIT 02

Binary System

Q.1: What is meant by number system. Explain different types of number systems.

Ans. Number System

A number system defines a set of values used to represent different quantities. It is for the representation of the numeric data. To understand about how computers store data in the memory and how they handle them, one must know about bits and bytes and the number systems.

Types of Number Systems

Different types of number systems are as follows:

- Decimal Number System
- Binary Number System
- Hexadecimal Number System
- Octal Number System

1. Decimal Number System

In our daily life, we use a system based on digits to represent numbers. The system that uses the decimal numbers or digit symbols 0 to 9 is called as the decimal number system. This system is said to have a base, or radix, of ten. Sequence of digit symbols are used to represent numbers greater than 9. When a number is written as a sequence of decimal digits, its value can be interpreted using the positional value of each digit in the number. The positional number system is a system of writing numbers where the value of a digit depends not only on the digit, but also on its placement within a number. In the positional number system, each decimal digit is weighted relative to its position in the number. This means that each digit in the number is multiplied by ten raised to a power corresponding to that digit's position. Thus the value of the decimal sequence 948 is:

$948 = 9 \times 10^2 + 4 \times 10^1 + 8 \times 10^0$

Fractional values are represented in the same manner, but the exponents are negative for digits on the right side of the decimal point. Thus the value of the fractional decimal sequence 948.23 is:

$948.23 = 9 \times 10^2 + 4 \times 10^1 + 8 \times 10^0 + 2 \times 10^{-1} + 3 \times 10^{-2}$

2. Binary Number System

Binary number system has base 2 as all the numbers in this system consist of only

two digits i.e. 0 and 1. Digital computers use this system to store data. The numbers in the binary system are represented to the base two and the positional multipliers are the powers of two. The leftmost bit in the binary number is called as the most significant bit (MSB) and it has the largest positional weight. The rightmost bit is the least significant bit (LSB) and has the smallest positional weight. Your name is in the form of alphabets, but for a computer each alphabet has some binary value.

Example: The binary value of the letter 'A' is 01000001 and its decimal value is 65.

3. Hexadecimal Number System

Hexadecimal representation of numbers is more efficient in digital applications because it occupies less memory space for storing large numbers. A hexadecimal number is represented using base 16. This system has total 16 numbers, i.e.0, 1, 2, 3, 4,5, 6, 7, 8, 9, A, B, C, D, E, F, where A=10, B=11, C=12, D=13, E=14 and F=15. Example: 2AB, 3F2B and etc.

The hexadecimal representation is more compact than binary representation. It is very easy to convert between binary and hexadecimal systems. Each hexadecimal digit will correspond to four binary digits because $2^4 = 16$.

4. Octal Number System

An octal number is represented using base 8. Octal representation is just a simple extension of binary and decimal representations but using only the digits 0 to7. To convert an octal number to a decimal number, it is required to multiply each octal digit by the appropriate power of 8 and add the results. E.g. $(560)_8$

Q.2: Write down the method to convert decimal number into binary and vice versa.

Ans. Conversion of decimal to Binary System

To convert a decimal number to binary, we divide the number by 2 and take quotient and remainder. We continue dividing the quotient by 2 until we get quotient 0. We write out all remainders in reverse order to obtain the value in binary.

Example: Convert 38_{10} to binary.

		remainder
2	38	
2	19	0
2	9	1
2	4	1
2	2	0
	1	0

The above table shows the method to solve this problem. Remainders are taken

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from bottom to top to present the binary number. So, $(38)_{10} = (100110)_2$

Example: Convert 115_{10} to binary.

The above table shows the method to solve this problem. Remainders are taken from bottom to top to present the binary number. So, $(115)_{10} = (1110011)_2$

Binary to Decimal Conversion

To convert a binary number to a decimal number, it is required to multiply each binary digit by the appropriate power of 2 and add the results. The conversion of a number from a binary number system to decimal number system is explained below with the help of an example.

Example 1: Convert $(1000001)_2$ to decimal.

$1000001_2 = 1 \times 2^6 + 0 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 1 \times 2^0$

$= 64 + 0 + 0 + 0 + 0 + 0 + 1$

$= 65_{10}$

The above conversion is done by the following steps:

- Write down the binary number which is $(1000001)_2$ in this example.
- List the powers of two from right to left starting with 0. In this example, the power of 2 starts from 0 and ends at 6.
- Multiply 2's corresponding powers to each binary value. In the above example there are 7 binary values.
- Compute each value.
- Add all the values.
- Write the answer along with its base subscript.

Example 2: Convert $(10000111)_2$ to decimal.

$10000111_2 = 1 \times 2^7 + 0 \times 2^6 + 0 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 1 \times 2^0$

$= 128 + 0 + 0 + 0 + 0 + 4 + 2 + 1$

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$= 135_{10}$

The above conversion is done by the following steps:

- Write down the binary number which is $(10000111)_2$ in this example.
- List the powers of two from right to left starting with 0. In this example, the power of 2 starts from 0 and ends at 7.
- Multiply 2's corresponding powers to each binary value. In the above example there are 8 binary values.
- Compute each value.
- Add all the values.
- Write the answer along with its base subscript.

Q.3: Write down the method to convert decimal number into hexadecimal number system and vice versa.

Ans: Conversion of decimal to Hexadecimal System

Decimal numbers' conversion to hexadecimal is similar to binary conversion. To convert a decimal number to hexadecimal, we divide the number by 16 and take quotient and remainder. We continue dividing the quotient by 16 until we get quotient 0. We write out all remainders in reverse order to obtain the value in hexadecimal.

Example 1: Convert $(3479)_{10}$ to hexadecimal.

16	3479			
16	217-7			
16	13-9	7 →	7	First Remainder
		9 →	9	Second Remainder
		13 →	D	Third Remainder
			Read up	

The above table shows the method to solve this problem. We can observe from the table that remainder D is the representation of 13. Remainders are taken from bottom to top to present the binary number. So, $(3479)_{10} = (D97)_{16}$

Example 2: Convert $(115)_{10}$ to hexadecimal.

Decimal to Hexadecimal

16	115		
16	7	3	$(115)_{10} = (73)_{16}$

The above table shows the method to solve this problem. Remainders are taken from bottom to top to present the binary number. So, $(115)_{10} = (73)_{16}$

Conversion of Hexadecimal to Decimal System

The method for this conversion is same as converting from binary to decimal except the base value. Since hexadecimal has base 16, the place values correspond to the powers of 16. To convert a hexadecimal number to a decimal number, it is required to multiply each place value by the corresponding power of 16 and add the results. Start this process by writing the powers of sixteen next to the digits of a hexadecimal number. The conversion of a number from a hexadecimal number system to decimal number system is explained below with the help of examples.

Example 1: Convert $(C921)_{16}$ to decimal.

$(C921)_{16} = C \times 16^3 + 9 \times 16^2 + 2 \times 16^1 + 1 \times 16^0$

$= 12 \times 16^3 + 9 \times 16^2 + 2 \times 16^1 + 1 \times 16^0$

$= 12 \times 4096 + 9 \times 256 + 2 \times 16 + 1 \times 1$

$= 49152 + 2304 + 32 + 1$

$= (51489)_{10}$

The above conversion is done by the following steps:

- Write down the hexadecimal number which is $(C921)_{16}$ in this example.
- List the powers of sixteen from right to left starting with 0. In this example, the power of 16 starts from 0 and ends at 3.
- Multiply 16's corresponding powers to each hexadecimal value. In the above example there are 4 hexadecimal values.
- Compute each value.
- Add all the values.
- Write the answer along with its base subscript.

Example 2: Convert $(2AB1)_{16}$ to decimal.

$(2AB1)_{16} = 2 \times 16^3 + A \times 16^2 + B \times 16^1 + 1 \times 16^0$

$= 2 \times 16^3 + 10 \times 16^2 + 11 \times 16^1 + 1 \times 16^0$

$= 2 \times 4096 + 10 \times 256 + 11 \times 16 + 1 \times 1$

$= 8192 + 2560 + 176 + 1$

$= (10929)_{10}$

The above conversion is done by the following steps:

- Write down the hexadecimal number which is $(2AB1)_{16}$ in this example.
- List the powers of sixteen from right to left starting with 0. In this example, the power of 16 starts from 0 and ends at 3.
- Multiply 16's corresponding powers to each hexadecimal value. In the above example there are 4 hexadecimal values.
- Compute each value.
- Add all the values.
- Write the answer along with its base subscript.

Q.4: Write down the method to convert hexadecimal number into binary number system and vice versa.

Ans. Conversion of Hexadecimal to Binary System

Hexadecimal or Hex numbers are used as a shorthand form of binary sequence. This system is used to represent data in a more compact manner. To convert a hexadecimal number to binary, simply convert each hexadecimal digit to four digits binary value. To find the four digits binary value, see the following table.

Hexadecimal	Binary
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
A	1010
B	1011
C	1100
D	1101
E	1110
F	1111

Example 1: Convert $(A23)_{16}$ to binary.

In this number, there are three hexadecimal digits. Binary of each digit is given as:

- For A, the binary value is 1010
- For 2, the binary value is 0010
- For 3, the binary value is 0011

By combining all the binary values, we get:

1010 0010 0011

So, $(A23)_{16} = (1010\ 0010\ 0011)_2$

Example 2: Convert $(2ABCF)_{16}$ to binary.

In this number, there are three hexadecimal digits. Binary of each digit is given as:

- For 2, the binary value is 0010

- For A, the binary value is 1010
- For B, the binary value is 1011
- For C, the binary value is 1100
- For F, the binary value is 1111

By combining all the binary values, we get:

0010 1010 1011 1100 1111

So, $(2ABCF)_{16} = (0010\ 1010\ 1011\ 1100\ 1111)_2$

Conversion of Binary into Hexadecimal System

Conversion of binary into hexadecimal system is very easy. In the given binary number, we start making groups of four digits from right to left and replace every group with a hexadecimal digit.

Example 1: Convert $(11000001)_2$ to hexadecimal.

The four digit binary groups in this binary number are given below where each group has four binary digits.

1100 0001

- For 1100, the hexadecimal is C
- For 0001, the hexadecimal is 1

So, $(11000001)_2 = (C1)_{16}$

While making groups from right to left, if the left group has less than 4 binary digits then we simply add 0s on the left. For example, 1010011 has groups 101 0011 and by adding one 0 on the left, it becomes 0101 0011.

Example 2: Convert $(111100110001)_2$ to hexadecimal.

The four digit binary groups in this binary number are given below where each group has four binary digits.

1111 0011 0001

- For 1111, the hexadecimal is F
- For 0011, the hexadecimal is 3
- For 0001, the hexadecimal is 1

So, $(111100110001)_2 = (F31)_{16}$

While making groups from right to left, if the left group has less than 4 binary digits then we simply add 0s on the left.

Q.5: Define memory. Explain its types.

Ans. Memory

Computer memory is any physical device capable of storing data. Primarily there are two types of memory:

- Volatile Memory
- Non volatile (Permanent) Memory

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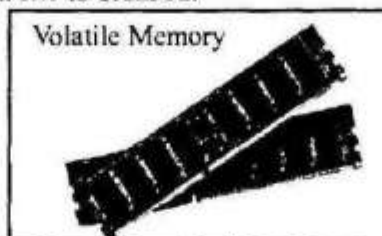
1. Volatile Memory (Primary Storage)

A device which holds data as long as it has power supply connected to it, is called volatile memory. Its best example is Random Access Memory (RAM), which holds memory as long as it is connected to power source. As soon as the power supply is disconnected, all the data in RAM is cleared.

Volatile Memory

2. Non-Volatile Memory (Secondary Storage)

A device which can hold data even if it is not connected to any power source is called non-volatile memory. The typical examples for non-volatile memory are hard drives, flash drives and memory cards installed in cell phones. Even if you turn off your computer, the data in your hard drive or flash drive stays intact.

Non-Volatile Memory

Q.6: Differentiate between temporary and permanent storage.

Ans. Temporary and permanent storage.

Temporary Memory	Permanent Memory/ Storage
It is expensive.	It is cheap.
It has small data storage capacity.	It has large data storage capacity.
It is directly connected to the processor.	It is not directly connected to the processor.
It provides fast access to data.	It does not provide fast access to data.

Q.7: How is data represented in computer memory?

Ans. Data Representation in Computer Memory

Digital computers store data in binary form. It means that whether it is a text, picture, movie or some application, it is stored in computer's memory in the form of 0s and 1s. All the characters on your keyboard has an associated code in binary. This code is called ASCII code of the character. ASCII stands for American Standard Code for Information Interchange. It is a de-facto standard for representation of data inside computer's memory. The following table presents the ASCII table which shows the code against each character on your keyboard. The codes are given in decimal form, but inside computer's memory they are represented after conversion to binary form.

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Ascii	Char	Ascii	Char	Ascii	Char	Ascii	Char
0	Null	32	Space	64	@	96	`
1	Start of heading	33	!	65	A	97	a
2	Start of text	34	"	66	B	98	b
3	End of text	35	#	67	C	99	c
4	End of transmit	36	$	68	D	100	d
5	Enquiry	37	%	69	E	101	e
6	Acknowledge	38	&	70	F	102	f
7	Audible bell	39	'	71	G	103	g
8	Backspace	40	(	72	H	104	h
9	Horizontal tab	41	)	73	I	105	i
10	Line feed	42	*	74	J	106	j
11	Vertical tab	43	+	75	K	107	k
12	Form feed	44	,	76	L	108	l
13	Carriage return	45	–	77	M	109	m
14	Shift in	46	.	78	N	110	n
15	Shift out	47	/	79	O	111	o
16	Data link escape	48	0	80	P	112	p
17	Device control 1	49	1	81	Q	113	q
18	Device control 2	50	2	82	R	114	r
19	Device control 3	51	3	83	S	115	s
20	Device control 4	52	4	84	T	116	t
21	Neg. acknowledge	53	5	85	U	117	u
22	Synchronous idle	54	6	86	V	118	v
23	End trans. block	55	7	87	W	119	w
24	Cancel	56	8	88	X	120	x
25	End of medium	57	9	89	Y	121	y
26	Substitution	58	:	90	Z	122	z
27	Escape	59	;	91	[	123	{
28	File separator	60	<	92	\	124	|
29	Group separator	61	=	93	]	125	}
30	Record separator	62	>	94	^	126	~
31	Unit separator	63	?	95	–	127	DEL

ASCII Table

Example:

To store name of our country "Pakistan", in computer's memory, we need to store code of each letter in one byte. As the word "Pakistan" contains 8 letters, so 8 bytes are required for storage. It is demonstrated in the following table:

Human's View about Memory	Code in Decimal	Code in Binary
'P'	80	1010000
'a'	97	1100001
'k'	107	1101011
'i'	105	1101001
's'	115	1110011
't'	116	1110100
'a'	97	1100001
'n'	110	1101110

Q.8: Explain storage device.

Ans. Storage Device.

Any computing hardware that is used for storing, porting and extracting data, is called a storage device. It can hold or store information both temporarily and permanently. Storage device can also be internal or external to a computer. An external storage device is a plug and play device, i.e. , we just plug it to some port and start using it without turning off a computer. To attach an internal storage device (Hard disk or RAM) we need to turn off the computer. Internal storage devices are connected to some fixed slots.

Examples: RAM, Hard Disk, CD, USB Flash Drive, etc.

Q.9: Differentiate between memory and storage.

Ans. Memory and storage.

Memory	Storage
Place where an application loads data during processing.	Usually the place where data is stored for long or short term.
It is a temporary storage device.	It is a permanent storage device.
It is lesser in size.	It is greater in size.
It provides fast access to data.	It does not provide fast access to data.
It is called primary memory.	It is called secondary memory.

Q.10: Explain the measurement of size of computer memory.

Ans. Measurement of Size of Computer Memory.

The smallest amount of data to be stored in computer's memory is a 0 or 1. It is called a bit. A collection of 8 bits is called a byte. At least one byte is required to store any piece of information in a computer storage. On both primary and secondary storage devices, data is stored in the form of bytes. The following table shows different units of data storage:

Unit	Size
Bit	Smallest unit of data, can old only one value 0 or 1.
Nibble	Group of four bits is called a nibble.
Byte	Group of eight bits, enough space to store single ASCII character.
KiloByte	1KB=1024 Bytes
MegaByte	1MB=1024 KB or $(1024)^2$ Bytes.
GigaByte	1GB=1024 MB or $(1024)^3$ Bytes.
TeraByte	1TB=1024 GB or $(1024)^4$ Bytes.
PetaByte	1PB=1024 TB or $(1024)^5$ Bytes.

Q.11: What is Boolean algebra?

Ans. Boolean algebra

Boolean algebra is the algebra of logic. It uses symbols to represent logical statements instead of words. Boolean algebra was formulated by the English Mathematician George Boole in 1847. Boolean algebra consists of rules for manipulating symbols. The most important application of the Boolean algebra is in digital logic. Computer chips are made up of transistors that are arranged in logical gates. Each gate performs a simple logical operation.

The computer processes the logical propositions in its program by processing electrical pulses. The design of a particular circuit is based on a set of logical statements.

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These statements can be translated into the symbols of Boolean algebra. The algebraic statements can then be simplified according to the rules of the algebra and translated into a simpler circuit design. Boolean algebra return results in terms of true or false i.e. 1 or 0 respectively.

Q.12: Explain Boolean proposition.

Ans. Boolean Proposition

A proposition is a sentence that can either be true or false. For example, the following sentences are propositions.

- Islamabad is the capital of Pakistan.
- Lahore is the capital of Punjab.
- I am Pakistani.
- I will top in Board exams.
- I want to excel in computer.
- I live in Vehari.

But the following sentences are not propositions.

- What is your name?
- How are you?
- Is it cold outside?

We can also assign some letter to a proposition, as shown in the following:

1. A= "Islamabad is the capital of Pakistan".
2. B= "I will top in Board exams".

Now when we say A, it means that we are referring to proposition "Islamabad is the capital of Pakistan", and when we say B, it means that we are referring to proposition "I will top in Board exams". True and false are called Boolean values. The idea was given by George Boole 2 November 1815- 8 December 1864 in his book "The Laws of Thought".

Q.13: What is meant by truth values?

Ans. Truth Values

Every proposition takes one of two values true or false, and these values are called truth values. Truth value is given on the basis of truthfulness or falsity of a proposition.

Example:

Assume P="Islamabad is the capital of Pakistan". You can assign the truth value true to this proposition. Now assume another proposition Q="The sun rises in the west". The truth value for this proposition is false. If we have proposition R="I have completed my homework", then the truth value depends on the person who is assigning it. If a person has completed his homework then he can assign truth value true, otherwise false.

Some more examples of truth values are as follows:

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- I am Pakistani. True
- 2+3=6 False
- Lahore is the capital of Pakistan. False
- 10-6=4 True

Q.14: Describe the logical operators (AND, OR, NOT).

Ans. logical operators (AND, OR, NOT)

Sometimes we assemble more than one propositions to make one proposition called a compound proposition. For example if we have the following two propositions:

1. Today is Monday
2. I am in school

Then "Today is Monday AND I am in school" is a compound proposition. Truth value of the compound proposition depends upon the truth values of the individual propositions and the logical operator used to connect the propositions. In this example "AND" is a logical operator. The logical operators let us combine simple condition to construct more complex condition. By condition, we means an expression evaluating to true or false. The basic logical operations are AND, OR and NOT, which are symbolically represented by dot, plus sign, and by over bar / single apostrophe.

A Boolean expression is a combination of Boolean variables, Boolean Constants and the logical operators. All possible operations in Boolean algebra can be created from these basic logical operators. There are no negative or fractional numbers in Boolean algebra. The operation AND gives true (binary value 1) if and only if both of its operands are true. The operation OR gives true if either or both of its operands are true. The unary operation NOT inverts the value of its operand. The basic logical operations can be defined in a form known as Truth Table, which is a list of all possible input values and the output response for each input combination.

AND operator (.)

The AND operator is defined in Boolean algebra by the use of the dot (.) operator. It is similar to multiplication in ordinary algebra. The AND operator combines two or more input variables (propositions) so that the output is true only if all the inputs (propositions) are true otherwise it is false. Example A AND B or it may also be written as A . B

OR operator (+)

The plus sign is used to indicate the OR operator. The OR operator combines two or more input variables (propositions) so that the output is true if at least one input (proposition) is true. In other words, the compound proposition is false only if all the inputs (propositions) are false. Example A OR B or it may also be written as A + B.

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NOT operator (¬)

The logical operator "NOT" is not a connector but it is used to negate a proposition. The NOT operator has one input and one output. The input is either true or false, and the output is always the opposite, that is, the NOT operator inverts the input. For example, if P="Today is Monday" the NOT(P) means "Today is not Monday". So, with NOT operator a true becomes false and vice versa. NOT operator can also be denoted by a "¬" symbol. It means that NOT(P) may also be written as ¬P.

The basic logic functions AND, OR, and NOT can also be combined to make other logic operators.

Q.15: What is truth table? Draw truth tables for the logical AND, OR and NOT operators.

Ans. Truth Table

The basic logical operations can be defined in a form known as Truth Table, which is a list of all possible input values and the output response for each input combination. A truth table is used to check whether a proposition is True or False. Usually it is used to check the truth value of a input/ proposition where some logical operator is used. The truth tables for AND, OR and NOT operators are as follows:

Truth Table for AND Operator

The truth table for P AND Q is given in the table below. The first two columns are showing all the possible combinations of truth values of propositions P and Q, the third column is showing the resultant truth value of P AND Q. Assume:

P = It is raining

Q = Today is Sunday

If both P and Q are True then P AND Q is also True, it means "It is raining on Sunday". This situation is shown on Row 1 of the given table. Suppose it is raining but not on Sunday. Then P is True and Q is False due to which P AND Q is also False (row 2 of the given table). In row 3 of table, P is False and Q is true. It means " it is not raining on Sunday" which results in False value of P AND Q. in last row both P and Q are False, which means "It is neither raining nor Sunday". So, the proposition 'It is raining and today is Sunday" is False (row 4 of the table).

P	Q	P AND Q
T	T	T
T	F	F
F	T	F
F	F	F

Truth Table for OR Operator

The truth table for P OR Q is given in the table below. The first two columns are

showing all the possible combinations of truth values of propositions P and Q, the third column is showing the resultant truth value of P OR Q. Assume:

P= It is raining

Q= Today is Sunday

For the propositions P and Q, let's see the truth table for the expression P OR Q. P OR Q="It is raining or it is Sunday". This compound proposition is False if it is not raining and today is not Sunday otherwise it is True as shown in the table given below:

P	Q	P OR Q
T	T	T
T	F	T
F	T	T
F	F	F

Truth Table for NOT Operator

We can also make truth table where NOT operator is used. Negation (also called NOT) is an operator that reverses the nature of a value, i.e. a value True becomes False and vice versa. The truth table for NOT operator is shown below:

P	NOT(P)
T	F
F	T

Truth Table for complex Boolean expression

We can make truth table for any combination of these operators. For example, if we need to make a truth table of "It is not raining and today is Sunday". It means the propositions NOT(P) AND Q. The truth table for this compound proposition is shown below:

P	NOT(P)	Q	NOT(P) AND Q
T	F	T	F
T	F	F	F
F	T	T	T
F	T	F	F

Q.16: Describe laws of Boolean algebra.

Ans. Laws of Boolean Algebra

The laws of Boolean Algebra help us to simplify complex Boolean expressions. If x, y and z are Boolean variables and 0 and 1 are the Boolean constants, then by using the '.', '+' and complement operations we can combine two or more variables and constants to make Boolean expression. Some laws of Boolean algebra are as follows:

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- **Commutative Law**

Commutative law states that the order of application of two separate propositions is not important. So,

a) A.B = B.A

The order in which two variables are AND'ed makes no difference.

b) A+B = B+A

The order in which two variables are OR'ed makes no difference.

We can use truth tables to verify this law for AND and OR operations respectively.

A	B	A.B	B.A
F	F	F	F
F	T	F	F
T	F	F	F
T	T	T	T

Truth Table for AND Operation

We can observe from the above table that both the columns A.B and B.A contain same values in each row. Thus it verifies the commutative law for AND operation. Similarly we can verify for OR operation from the table given below.

A	B	A+B	B+A
F	F	F	F
F	T	T	T
T	F	T	T
T	T	T	T

Truth Table for OR Operation

- **Associative Law**

This law is for several variables. According to this law there is no change in results if a grouping of expressions is changed. This law is quite same in case of AND and OR operators.

a) (A+B)+C = A+(B+C) b) (A.B).C = A.(B.C)

In order to verify the associative law for OR operation, we can observe the Truth Table presented in the given table. Both columns (A+B) + C and A + (B+C) contain same values in each row. It verifies the associative law for OR operation.

A	B	C	A + B	B + C	(A + B) +C	A + (B + C)
F	F	F	F	F	F	F
F	F	T	F	T	T	T
F	T	F	T	T	T	T
F	T	T	T	T	T	T

T	F	F	T	F	T	T
T	F	T	T	T	T	T
T	T	F	T	T	T	T
T	T	T	T	T	T	T

Truth Table for OR Operation

Similarly, we can observe Truth Table given below for verification of Associative Law for AND operation.

A	B	C	A.B	B.C	(A.B).C	A.(B.C)
F	F	F	F	F	F	F
F	F	T	F	F	F	F
F	T	F	F	F	F	F
F	T	T	F	T	F	F
T	F	F	F	F	F	F
T	F	T	F	F	F	F
T	T	F	T	F	F	F
T	T	T	T	T	T	T

Truth Table for AND Operation

- **Distributive Law**

This law is discussed in two ways, i.e. "AND over OR" and "OR over AND".

a) A.(B + C) = (A.B) + (A.C) (AND over OR)

b) A + (B.C) = (A + B). (A + C) (OR over AND)

We can verify the distributive law for (AND over OR) operation by using truth table as well.

A	B	C	B + C	A.B	A.C	A.(B + C)	A.B + A.C
F	F	F	F	F	F	F	F
F	F	T	T	F	F	F	F
F	T	F	T	F	F	F	F
F	T	T	T	F	F	F	F
T	F	F	F	F	F	F	F
T	F	T	T	F	T	T	T
T	T	F	T	T	F	T	T
T	T	T	T	T	T	T	T

- **Identity Law**

If a variable is OR'ed with a False, the result is always equal to that variable. And if a variable is AND'ed with a True, the result is always equal to that variable.

a) A OR False = A, A variable OR'ed with False is always equal to that variable.
b) A AND True = A, A variable AND'ed with True is always equal to that variable.

Q.17: Explain logical expressions.

Ans. Logical Expressions

A logical expression is a combination of Boolean variables, Boolean Constants and the logical operators. We get a logical expression when some logical operator is applied to the Boolean propositions.

Example:

(X+Y) + Z =X + (Y+Z)

The following truth table is according to some logical expression:

X	Y	Z	X + Y	Y + Z	(X + Y) +Z	X + (Y + Z)
F	F	F	F	F	F	F
F	F	T	F	T	T	T
F	T	F	T	T	T	T
F	T	T	T	T	T	T
T	F	F	T	F	T	T
T	F	T	T	T	T	T
T	T	F	T	T	T	T
T	T	T	T	T	T	T

Truth Table for Logical OR Operation

Q.18: Draw a truth table for the following expression.

A + (B.C) = (A + B). (A + C)

Ans. Truth Table

A	B	C	B.C	A + B	A + C	A +(B.C)	A+B.A+C
F	F	F	F	F	F	F	F
F	F	T	F	F	T	F	F
F	T	F	F	T	F	F	F
F	T	T	T	T	T	T	T
T	F	F	F	T	T	T	T
T	F	T	F	T	T	T	T
T	T	F	F	T	T	T	T
T	T	T	T	T	T	T	T

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SUMMARY

- Binary language consists of 0s and 1s. Computer understands only binary language.
- Decimal number system has base 10 as it uses ten digits from 0 to 9.
- Hexadecimal system has total 16 numbers, i.e., 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, A, B, C, D, E, F.
- Computer memory is a physical device capable of storing information temporarily or permanently.
- A device which holds the data as long as it has power supply connected to it and loses the memory when there is no power supply connected to it is called volatile memory or temporary memory.
- A device which can hold data even if it is not connected to any power source is called non volatile memory or permanent memory.
- A storage device is a hardware that is used for storing, porting and extracting data.
- Boolean states either can be True or False.
- A truth table is used to show whether the statement is True or False.
- Associative law
  - $(A + B) + C = A + (B + C)$
  - $(A.B).C = A.(B.C)$
- Commutative law
  - $A + B = B + A$
  - $A.B = B.A$
- Distributive law
  - $A.(B + C) = (A.B) + (A.C)$
  - $A + (B.C) = (A + B).(A + C)$
- Identity law
  - $A + 0 = A$
  - $A.1 = A$

SOLVED EXERCISE

2.1 Choose the correct option.

1. Expression (A + B) . (A + C) is equal to ________.

(i) $A + (B.C)$ (ii) $A.B + A.C$ (iii) $A.(B.C)$ (iv) $A + (B + C)$

2. The order of application of two separate terms is not important in.

(i) Associative Law (ii) Commutative Law
(iii) Distributive Law (iv) Identity Law

3. "Is it cold outside" is ___________.

(i) Boolean Proposition (ii) Categorical proposition

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(iii) Moral propositions (iv) None of above

4. Number "17" is equal to _____ in binary system.

(i) 10000 (ii) 10110 (iii) 10001 (iv) 10100

5. 1 Petabyte is equal to______.

(i) $(1,024)^4$ bytes (ii) $(1,024)^6$ bytes
(iii) $(1,024)^5$ bytes (iv) $(1,024)^7$ bytes

6. Hexadecimal system has total ________ numbers.

(i) 17 (ii) 16 (iii) 18 (iv) 15

Answers:

1.	A + (B.C)	**2.**	Commutative Law	**3.**	Boolean Proposition
4.	10001	**5.**	$(1,024)^5$ bytes	**6.**	16

2.2 Answer the following questions.

1. Convert $(69610)_{10}$ to Hexadecimal.

Ans. $(69610)_{10} = (\ ?\ )_{16}$

16	69610
16	4350 - 10
16	271 - 14
16	16 - 15
	1 - 0

So, $(69610)_{10} = (10FEA)_{16}$

2. Differentiate between volatile and non-volatile memory.

Ans. See question no. 5

3. Store the word "Phone" in computer memory starting from address 7003 where each letter needs one byte to store in the memory.

Ans. Storing the word "Phone" in computer memory. Where

P	=	80	=	1010000	=	01010000
h	=	104	=	1101000	=	01101000
o	=	111	=	1101111	=	01101111
n	=	110	=	1101110	=	01101110
e	=	101	=	1100101	=	01100101

So,

Phone = 01010000 01101000 01101111 01101110 01100101

4. Differentiate between temporary and permanent storage.

Ans. See question no. 6

5. Write the truth table for X AND Y where

X = It is sunny

Y = Today is Monday

Ans. Truth Table

X	Y	X AND Y
T	T	T
T	F	F
F	T	F
F	F	F

2.3 Fill in the blanks

1. Temporary memory is _________ and permanent memory is _________.
2. Data to a processor is provided through _________.
3. At least _________ byte is required to store any piece of information in a computer's memory.
4. _________ is used to assemble more than one propositions into one proposition.
5. In primary and secondary storages, data is stored in the form of _________.
6. According to _________ law there is no change in results if priority of expressions is changed.

Answers:

1. Volatile, Non-Volatile 2. RAM 3. One
4. Compound Proposition 5. Bytes 6. Associative

2.4 Perform the following conversions.

1. $(ABCD)_{16}$ to binary.

Sol: $(ABCD)_{16} = (?)_2$

A = 1010
B = 1011
C = 1100
D = 1101

So, $(ABCD)_{16} = (1010\ 1011\ 1100\ 1101)_2$

2. $(0010110010001101001)_2$ to hexadecimal.

Sol: $(0010110010001101001)_2 = (?)_{16}$

While making groups from right to left, if the left group has less than 4 binary digits then we simply add 0s on the left.

* for 0001 , the hexadecimal is 1
* for 0110 , the hexadecimal is 6
* for 0100 , the hexadecimal is 4
* for 0110 , the hexadecimal is 6
* for 1001 , the hexadecimal is 9

So,

$(0010110010001101001)_2 = (16469)_{16}$

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Objective Type Questions

- **Choose the correct answer:**

1. Binary language consists of:
(a) 0's and 1's (b) 1's and 2's (c) 0's and 2's (d) 0's and 3's

2. Computer understands only:
(a) Assembly Language (b) C++ Language
(c) Basic Language (d) Binary Language

3. Decimal number system has base:
(a) 2 (b) 8 (c) 10 (d) 16

4. The number system used by humans:
(a) Binary (b) Decimal (c) Octal (d) Hexadecimal

5. Binary number system has base:
(a) 2 (b) 8 (c) 10 (d) 16

6. Octal number system has base:
(a) 2 (b) 8 (c) 10 (d) 16

7. Hexadecimal number system has base:
(a) 2 (b) 8 (c) 10 (d) 16

8. In hexadecimal system alphabet C is equal to:
(a) 10 (b) 11 (c) 12 (d) 13

9. In hexadecimal system alphabet A is equal to:
(a) 10 (b) 11 (c) 12 (d) 13

10. In hexadecimal system alphabet F is equal to:
(a) 13 (b) 15 (c) 11 (d) 14

11. The leftmost bit in the binary number is called:
(a) LSB (b) RSB (c) MSB (d) NSB

12. The rightmost bit in the binary number is called:
(a) LSB (b) RSB (c) MSB (d) NSB

13. It has the largest positional weight:
(a) LSB (b) RSB (c) MSB (d) NSB

14. It has the smallest positional weight:
(a) LSB (b) RSB (c) MSB (d) NSB

15. ____________ is a physical device capable of storing information.
(a) Computer memory (b) Processor
(c) Motherboard (d) Mouse

16. Computer memory can store data:
(a) Temporarily only (b) Permanently only
(c) Temporarily & permanently (d) for one day

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17. **Primarily there are __________ types of memory.**
    (a) 5 (b) 4 (c) 3 (d) 2
18. **Temporary memory is called:**
    (a) Volatile Memory (b) Non-Volatile Memory
    (c) Semi Volatile (d) Semi Non-Volatile Memory
19. **Permanent memory is called:**
    (a) Volatile Memory (b) Non-Volatile Memory
    (c) Semi Volatile (d) Semi Non-Volatile Memory
20. **Which of the following is the example of volatile memory?**
    (a) Hard Disk (b) Floppy Disk (c) ROM (d) RAM
21. **Which of the following is the example of non-volatile memory?**
    (a) Hard Disk (b) Floppy Disk (c) CD (d) All of These
22. **Data to a processor is provided through _________.**
    (a) Hard Disk (b) Floppy Disk (c) ROM (d) RAM
23. **Digital computers store data in_________ form.**
    (a) Binary (b) Decimal (c) Octal (d) Hexadecimal
24. **Types of computer storage:**
    (a) Internal (b) External (c) Both (a) & (b) (d) None of these
25. **Which of the following is a plug and play storage device?**
    (a) Internal (b) External (c) Both (a) & (b) (d) None of these
26. **The smallest amount of data to be stored in computer's memory is a 0 or 1. It is called:**
    (a) Bit (b) Nibble (c) Byte (d) Kilobyte (KB)
27. **Group of four bits is called:**
    (a) Bit (b) Nibble (c) Byte (d) Kilobyte (KB)
28. **A collection of 8 bits is called:**
    (a) Bit (b) Nibble (c) Byte (d) Kilobyte (KB)
29. **At least _________ byte is required to store any piece of information in a computer's memory.**
    (a) Bit (b) Nibble (c) Byte (d) Kilobyte (KB)
30. **Collection of 1024 bytes is called:**
    (a) Bit (b) Nibble (c) Byte (d) Kilobyte (KB)
31. **Collection of 1024 KB is called:**
    (a) Mega Byte (b) Giga Byte (c) Tera Byte (d) Peta Byte
32. **1 Giga byte is equal to____________.**
    (a) $(1024)^2$ Bytes (b) $(1024)^3$ Bytes (c) $(1024)^4$ Bytes (d) $(1024)^5$ Bytes
33. **1 Tera byte is equal to____________.**
    (a) $(1024)^2$ Bytes (b) $(1024)^3$ Bytes (c) $(1024)^4$ Bytes (d) $(1024)^5$ Bytes

34. In primary and secondary storages, data is stored in the form of ________.
(a) Bits (b) Nibbles (c) Bytes (d) Kilobytes

35. Boolean algebra was formulated by the English Mathematician George Boole in:
(a) 1842 (b) 1844 (c) 1845 (d) 1847

36. A ____________ is a sentence that can either be true or false.
(a) Proposition (b) Circuit (c) Truth Table (d) Gate

37. Sometimes we assemble more than one propositions to make one proposition called:
(a) Simple Proposition (b) Compound proposition
(c) Mix Proposition (d) Binomial proposition

38. The ___________ let us combine simple condition to construct more complex condition.
(a) Logical operators (b) Arithmetic Operators
(c) Relational Operators (d) Assignment Operator

39. A ___________ is a combination of Boolean variables, Boolean Constants and the logical operators.
(a) Logical expression (b) Arithmetic expression
(c) Relational expression (d) Boolean expression

40. The ______ operator is defined in Boolean algebra by the use of the dot (.) operator.
(a) OR (b) NOT (c) AND (d) NOR

41. The plus sign is used to indicate the _________ operator.
(a) OR (b) NOT (c) AND (d) NOR

42. According to _________ law there is no change in results if priority of expressions is changed.
(a) Associative (b) Commutative (c) Identity (d) Distributive

43. ___________ law states that the order of application of two separate propositions is not important.
(a) Associative (b) Commutative (c) Identity (d) Distributive

Answers:

1. 0's and 1's	**2.** Binary Language	**3.** 10	**4.** Decimal
5. 2	**6.** 8	**7.** 16	**8.** 12
9. 10	**10.** 15	**11.** MSB	**12.** LSB
13. MSB	**14.** LSB	**15.** Computer memory	
16. Temporarily & permanently		**17.** 2	**18.** Volatile Memory
19. Non-Volatile Memory		**20.** RAM	**21.** All of These
22. RAM	**23.** Binary	**24.** Both (a) & (b)	**25.** External

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26. Bit **27.** Nibble **28.** Byte **29.** Byte
30. Kilobyte (KB) **31.** Mega Byte **32.** $(1024)^3$ Bytes **33.** $(1024)^4$ Bytes
34. Bytes **35.** 1847 **36.** Proposition
37. Compound proposition **38.** Logical operators
39. Boolean expression **40.** AND **41.** OR
42. Associative **43.** Commutative

- **Give Short Answers:**

1. Define Number System.

Ans. Number System: A number system defines a set of values used to represent different quantities. It is for the representation of the numeric data. To understand about how computers store data in the memory and how they handle them, one must know about bits and bytes and the number systems.

2. What are the types of number systems?

Ans. Types of Number Systems: Different types of number systems are as follows:

(i) Decimal Number System **(ii)** Binary Number System
(iii) Hexadecimal Number System **(iv)** Octal Number System

3. Define Decimal Number System.

Ans. Decimal Number System: In our daily life, we use a system based on digits to represent numbers. The system that uses the decimal numbers or digit symbols 0 to 9 is called as the decimal number system. This system is said to have a base, or radix, of ten. Sequence of digit symbols are used to represent numbers greater than 9. E.g. $(980)_{10}$, $(3410)_{10}$ etc.

4. What is meant by positional number system?

Ans. Positional Number System: The positional number system is a system of writing numbers where the value of a digit depends not only on the digit, but also on its placement within a number. In the positional number system, each decimal digit is weighted relative to its position in the number. This means that each digit in the number is multiplied by ten raised to a power corresponding to that digit's position.

5. Define Binary Number System.

Ans. Binary Number System: Binary number system has base 2 as all the numbers in this system consist of only two digits i.e. 0 and 1. Digital computers use this system to store data. The numbers in the binary system are represented to the base two and the positional multipliers are the powers of two.

6. What is meant by MSB?

Ans. MSB: The leftmost bit in the binary number is called as the most significant bit (MSB) and it has the largest positional weight.

7. What is meant by LSB?

Ans. LSB: The rightmost bit is the least significant bit (LSB) and has the smallest positional weight.

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8. Write down the binary value of letter 'A'.

Ans. The binary value of the letter 'A' is 01000001 and its decimal value is 65.

9. Define Hexadecimal Number System.

Ans. Hexadecimal Number System: Hexadecimal representation of numbers is more efficient in digital applications because it occupies less memory space for storing large numbers. A hexadecimal number is represented using base 16. This system has total 16 numbers, i.e.0, 1, 2, 3, 4,5, 6, 7, 8, 9, A, B, C, D, E, F, where A=10, B=11, C=12, D=13, E=14 and F=15. Example: 2AB, 3F2B and etc.

10. Define Octal Number System

Ans. Octal Number System: An octal number is represented using base 8. Octal representation is just a simple extension of binary and decimal representations but using only the digits 0 to7. To convert an octal number to a decimal number, it is required to multiply each octal digit by the appropriate power of 8 and add the results. E.g. $(560)_8$

11. How we convert decimal number into binary number?

Ans. Conversion of decimal to Binary System: To convert a decimal number to binary, we divide the number by 2 and take quotient and remainder. We continue dividing the quotient by 2 until we get quotient 0. We write out all remainders in reverse order to obtain the value in binary.

12. Convert $(38)_{10}$ to binary.

Ans. $(38)_{10} = (?)_2$

		remainder
2	38	
2	19	0
2	9	1
2	4	1
2	2	0
	1	0

So, $(38)_{10} = (100110)_2$

13. Write down the method to convert a binary number into decimal.

Ans. Binary to Decimal Conversion: To convert a binary number to a decimal number, it is required to multiply each binary digit by the appropriate power of 2 and add the results.

14. Convert $(1000000)_2$ to decimal.

Ans. $(1000000)_2 = (?)_{10}$

$$1000000_2 = 1 \times 2^6 + 0 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 0 \times 2^2 + 0 \times 2^1 + 0 \times 2^0$$
$$= 64 + 0 + 0 + 0 + 0 + 0 + 0$$
$$= 64_{10}$$

So, $(1000000)_2 = (64)_{10}$

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15. Convert $(00000110)_2$ to decimal.

Ans. $(00000110)_2 = (?)_{10}$

$00000110_2 = 0 \times 2^7 + 0 \times 2^6 + 0 \times 2^5 + 0 \times 2^4 + 0 \times 2^3 + 1 \times 2^2 + 1 \times 2^1 + 0 \times 2^0$

$= 0 + 0 + 0 + 0 + 0 + 4 + 2 + 0$

$= 6_{10}$

So, $(00000110)_2 = (6)_{10}$

16. Write down the method to convert decimal number into hexadecimal number system.

Ans. Conversion of decimal to Hexadecimal System: Decimal numbers' conversion to hexadecimal is similar to binary conversion. To convert a decimal number to hexadecimal, we divide the number by 16 and take quotient and remainder. We continue dividing the quotient by 16 until we get quotient 0. We write out all remainders in reverse order to obtain the value in hexadecimal.

17. Convert $(3479)_{10}$ to hexadecimal.

Ans. $(3479)_{10} = (?)_{16}$

16	3479			
16	217-7			
16	13-9	7 → 7	↑	First Remainder
		9 → 9		Second Remainder
		13 → D		Third Remainder

Read up

So, $(3479)_{10} = (D97)_{16}$

18. Convert $(115)_{10}$ to hexadecimal.

Ans. $(115)_{10} = (?)_{16}$

Decimal to Hexadecimal

16	115	
16	7	3

$(115)_{10} = (73)_{16}$

So, $(115)_{10} = (73)_{16}$

19. Write down the method to convert Hexadecimal to Decimal System.

Ans. Conversion of Hexadecimal to Decimal System: The method for this conversion is same as converting from binary to decimal except the base value. Since hexadecimal has base 16, the place values correspond to the powers of 16. To convert a hexadecimal number to a decimal number, it is required to multiply each place value by the corresponding power of 16 and add the results. Start this process

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by writing the powers of sixteen next to the digits of a hexadecimal number.

20. Convert $(C910)_{16}$ to decimal.

Ans. $(C910)_{16} = (?)_{10}$

$(C910)_{16} = C \times 16^3 + 9 \times 16^2 + 1 \times 16^1 + 0 \times 16^0$

$= 12 \times 16^3 + 9 \times 16^2 + 1 \times 16^1 + 0 \times 16^0$

$= 12 \times 4096 + 9 \times 256 + 1 \times 16 + 0 \times 1$

$= 49152 + 2304 + 16 + 0$

$= (51472)_{10}$

So, $(C910)_{16} = (51472)_{10}$

21. Convert $(2AC1)_{16}$ to decimal.

Ans. $(2AC1)_{16} = (?)_{10}$

$(2AC1)_{16} = 2 \times 16^3 + A \times 16^2 + C \times 16^1 + 1 \times 16^0$

$= 2 \times 16^3 + 10 \times 16^2 + 12 \times 16^1 + 1 \times 16^0$

$= 2 \times 4096 + 10 \times 256 + 12 \times 16 + 1 \times 1$

$= 8192 + 2560 + 192 + 1$

$= (10945)_{10}$

So, $(2AC1)_{16} = (10945)_{10}$

22. Write down the method to convert hexadecimal number into binary number system.

Ans. Conversion of Hexadecimal to Binary System: Hexadecimal or Hex numbers are used as a shorthand form of binary sequence. This system is used to represent data in a more compact manner. To convert a hexadecimal number to binary, simply convert each hexadecimal digit to four digits binary value.

23. Convert $(A23)_{16}$ into binary.

Ans. $(A23)_{16} = (?)_2$

In this number, there are three hexadecimal digits. Binary of each digit is given as:

For A, the binary value is 1010

For 2, the binary value is 0010

For 3, the binary value is 0011

By combining all the binary values, we get:

1010 0010 0011

So, $(A23)_{16} = (1010\ 0010\ 0011)_2$

24. Write down the method to convert Binary into Hexadecimal System.

Ans. Conversion of Binary into Hexadecimal System: Conversion of binary into hexadecimal system is very easy. In the given binary number, we start making groups of four digits from right to left and replace every group with a hexadecimal digit.

25. Convert $(11000001)_2$ to hexadecimal.

Ans. $(11000001)_2 = (?)_{16}$

The four digit binary groups in this binary number are given below where each group has four binary digits.

1100 0001

For 1100, the hexadecimal is C

For 0001, the hexadecimal is 1

So, $(11000001)_2 = (C1)_{16}$

26. Define memory. Explain its types.

Ans. Memory: Computer memory is any physical device capable of storing data. E.g. RAM, Hard Disk and etc.

27. Write down the types of memory.

Ans. Types of Memory:

Primarily there are two types of memory:

- ☆ Volatile Memory
- ☆ Non volatile (Permanent) Memory

28. Define volatile memory.

Ans. Volatile Memory (Primary Storage): A device which holds data as long as it has power supply connected to it, is called volatile memory. Its best example is Random Access Memory (RAM), which holds memory as long as it is connected to power source. As soon as the power supply is disconnected, all the data in RAM is cleared.

29. Define non-volatile memory.

Ans. Non-Volatile Memory (Secondary Storage): A device which can hold data even if it is not connected to any power source is called non-volatile memory. The typical examples for non-volatile memory are hard drives, flash drives and memory cards installed in cell phones. Even if you turn off your computer, the data in your hard drive or flash drive stays intact.

30. Differentiate between temporary and permanent storage (Any two).

Ans.

Temporary Memory/Storage	Permanent Memory Storage
It is expensive.	It is cheap.
It has small data storage capacity.	It has large data storage capacity.

31. How is data represented in computer memory?

Ans. Data Representation in Computer Memory:

Digital computers store data in binary form. It means that whether it is a text, picture, movie or some application, it is stored in computer's memory in the form of 0s and 1s.

32. What is meant by ASCII code?

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Ans. ASCII Code: All the characters on your keyboard has an associated code in binary. This code is called ASCII code of the character. ASCII stands for American Standard Code for Information Interchange. It is a de-facto standard for representation of data inside computer's memory.

33. Define storage device.

Ans. Storage Device: Any computing hardware that is used for storing, porting and extracting data, is called a storage device. It can hold or store information both temporarily and permanently.

34. What are the types of storage devices?

Ans. Types of Storage Devices: Storage device can also be internal or external to a computer. An external storage device is a plug and play device, i.e. , we just plug it to some port and start using it without turning off a computer. To attach an internal storage device (Hard disk or RAM) we need to turn off the computer. Internal storage devices are connected to some fixed slots.

35. Write down the examples of storage devices.

Ans. Examples: RAM, Hard Disk, CD, USB Flash Drive, etc

36. Differentiate between memory and storage (Any Two).

Ans.

Memory	Storage
It is a temporary storage device.	It is a permanent storage device.
It is lesser in size.	It is greater in size.

37. Define bit.

Ans. Bit: The smallest amount of data to be stored in computer's memory is a 0 or 1. It is called a bit.

38. Define nibble.

Ans. Nibble: Group of four bits is called a nibble.

39. Define byte.

Ans. Byte: A collection of 8 bits is called a byte. At least one byte is required to store any piece of information in a computer storage. On both primary and secondary storage devices, data is stored in the form of bytes.

40. Define kilo byte.

Ans. Kilo Byte: Collection of 1024 bytes is called kilo byte. It is represented by KB.

41. Define mega byte.

Ans. Mega Byte: Collection of 1024 kilo bytes is called mega byte. It is represented by MB. 1MB=1024 KB or $(1024)^2$ Bytes.

42. Define Giga byte.

Ans. Giga Byte: Collection of 1024 mega bytes is called Giga byte. It is represented by GB. 1GB=1024 MB or $(1024)^3$ Bytes.

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43. Define Tera byte.

Ans. Tera Byte: Collection of 1024 Giga bytes is called Tera byte. It is represented by TB. 1TB=1024 GB or $(1024)^4$ Bytes.

44. Define Peta byte.

Ans. Peta Byte: Collection of 1024 Tera bytes is called Peta byte. It is represented by PB. 1PB=1024 TB or $(1024)^5$ Bytes.

45. What is Boolean algebra?

Ans. Boolean algebra: Boolean algebra is the algebra of logic. It uses symbols to represent logical statements instead of words. Boolean algebra was formulated by the English Mathematician George Boole in 1847. Boolean algebra consists of rules for manipulating symbols. Boolean algebra return results in terms of true or false i.e. 1 or 0 respectively.

46. Write down the most important application of the Boolean algebra.

Ans. The most important application of the Boolean algebra is in digital logic. Computer chips are made up of transistors that are arranged in logical gates. Each gate performs a simple logical operation.

47. How did the computer process propositions?

Ans. The computer processes the logical propositions in its program by processing electrical pulses.

48. On which bases a particular circuit is designed?

Ans. The design of a particular circuit is based on a set of logical statements. These statements can be translated into the symbols of Boolean algebra. The algebraic statements can then be simplified according to the rules of the algebra and translated into a simpler circuit design.

49. Define Boolean proposition.

Ans. Boolean Proposition

A proposition is a sentence that can either be true or false. For example, the following sentences are propositions.

- Islamabad is the capital of Pakistan.
- I am Pakistani.

50. Who gave the idea of a proposition?

Ans. The idea was given by George Boole (2 November 1815- 8 December 1864) in his book "The Laws of Thought".

51. What is meant by truth values?

Ans. Truth Values

Every proposition takes one of two values true or false, and these values are called truth values. Truth value is given on the basis of truthfulness or falsity of a proposition. Some more examples of truth values are as follows:

- Lahore is the capital of Pakistan. False

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- 10-6=4 True

52. What is meant by compound proposition?

Ans. Compound Proposition

Sometimes we assemble more than one propositions to make one proposition called a compound proposition. "Today is Monday AND I am in school" is a compound proposition.

53. What is the use of logical operators?

Ans. Use of Logical Operators

The logical operators let us combine simple condition to construct more complex condition. By condition, we means an expression evaluating to true or false.

54. Write down the names of logical operators.

Ans. Names of Logical Operators

The basic logical operators are AND, OR and NOT, which are symbolically represented by dot, plus sign, and by over bar / single apostrophe.

55. Define Boolean expression.

Ans. Boolean Expression

A Boolean expression is a combination of Boolean variables, Boolean Constants and the logical operators. All possible operations in Boolean algebra can be created from these basic logical operators.

56. Define AND operator.

Ans. AND operator

The AND operator is defined in Boolean algebra by the use of the dot (.) operator. It is similar to multiplication in ordinary algebra. The AND operator combines two or more input variables (propositions) so that the output is true only if all the inputs (propositions) are true otherwise it is false. Example A AND B or it may also be written as A . B

57. Define OR operator.

Ans. OR operator

The plus sign is used to indicate the OR operator. The OR operator combines two or more input variables (propositions) so that the output is true if at least one input (proposition) is true. In other words, the compound proposition is false only if all the inputs (propositions) are false. Example A OR B or it may also be written as A + B.

58. Define NOT operator.

Ans. NOT operator

The logical operator "NOT" is not a connector but it is used to negate a proposition. The NOT operator has one input and one output. The input is either true or false, and the output is always the opposite, that is, the NOT operator inverts the input. For example, if P="Today is Monday" the NOT(P) means "Today is not Monday".

NOT operator can also be denoted by a "−" symbol. It means that NOT(P) may also be written as $\overline{P}$.

59. What is truth table?

Ans. Truth Table

The basic logical operations can be defined in a form known as Truth Table, which is a list of all possible input values and the output response for each input combination. A truth table is used to check whether a proposition is True or False. Usually it is used to check the truth value of a input/ proposition where some logical operator is used.

60. Draw a Truth Table for AND Operator

Ans. Truth Table for AND Operator

P	Q	P AND Q
T	T	T
T	F	F
F	T	F
F	F	F

61. Draw a Truth Table for OR Operator

Ans. Truth Table for OR Operator

P	Q	P OR Q
T	T	T
T	F	T
F	T	T
F	F	F

62. Draw a Truth Table for NOT Operator

Ans. Truth Table for NOT Operator

P	NOT(P)
T	F
F	T

63. Draw a truth table of compound proposition "It is not raining and today is Sunday".

Ans. Truth Table for complex Boolean expression

We can make truth table for any combination of these operators. For example, if we need to make a truth table of "It is not raining and today is Sunday". It means the propositions NOT(P) AND Q. The truth table for this compound proposition is shown below:

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P	NOT(P)	Q	NOT(P) AND Q
T	F	T	F
T	F	F	F
F	T	T	T
F	T	F	F

64. What is the use laws of Boolean algebra?

Ans. Laws of Boolean Algebra

The laws of Boolean Algebra help us to simplify complex Boolean expressions.

65. Write down the names of laws of Boolean algebra.

Ans. Laws of Boolean algebra

Some laws of Boolean algebra are as follows:

- Commutative Law
- Associative Law
- Distributive Law
- Identity Law

66. Define commutative law.

Ans. Commutative Law: Commutative law states that the order of application of two separate propositions is not important. So,

c) $A.B = B.A$

The order in which two variables are AND'ed makes no difference.

d) $A+B = B+A$

The order in which two variables are OR'ed makes no difference.

67. Draw a truth table to verify commutative law for AND operation.

Ans. Truth Table

Truth table to verify commutative law for AND operation is as follows:

A	B	A.B	B.A
F	F	F	F
F	T	F	F
T	F	F	F
T	T	T	T

68. Draw a truth table to verify commutative law for OR operation.

Ans. Truth Table

Truth table to verify commutative law for OR operation is as follows:

A	B	A+B	B+A
F	F	F	F
F	T	T	T
T	F	T	T
T	T	T	T

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69. Define Associative law.

Ans. Associative Law

Associative law is for several variables. According to this law there is no change in results if a grouping of expressions is changed. This law is quite same in case of AND and OR operators.

a) (A+B)+C = A+(B+C) b) (A.B).C = A.(B.C)

70. Draw a truth table to verify associative law for OR operation.

Ans. Truth Table

Truth table to verify associative law for OR operation is as follows:

A	B	C	A + B	B + C	(A + B) + C	A + (B + C)
F	F	F	F	F	F	F
F	F	T	F	T	T	T
F	T	F	T	T	T	T
F	T	T	T	T	T	T
T	F	F	T	F	T	T
T	F	T	T	T	T	T
T	T	F	T	T	T	T
T	T	T	T	T	T	T

71. Draw a truth table to verify associative law for AND operation.

Ans. Truth Table

Truth table to verify associative law for AND operation is as follows:

A	B	C	A.B	B.C	(A.B).C	A.(B.C)
F	F	F	F	F	F	F
F	F	T	F	F	F	F
F	T	F	F	F	F	F
F	T	T	F	T	F	F
T	F	F	F	F	F	F
T	F	T	F	F	F	F
T	T	F	T	F	F	F
T	T	T	T	T	T	T

72. Define Distributive law.

Ans. Distributive Law

This law is discussed in two ways, i.e. "AND over OR" and "OR over AND".

c) A.(B + C) = (A.B) + (A.C) (AND over OR)

d) A + (B.C) = (A + B). (A + C) (OR over AND)

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73. Draw a truth table to verify distributive law.

Ans. Truth Table

We can verify the distributive law for (AND over OR) operation by using truth table as well.

A	B	C	B + C	A.B	A.C	A.(B + C)	A.B + A.C
F	F	F	F	F	F	F	F
F	F	T	T	F	F	F	F
F	T	F	T	F	F	F	F
F	T	T	T	F	F	F	F
T	F	F	F	F	F	F	F
T	F	T	T	F	T	T	T
T	T	F	T	T	F	T	T
T	T	T	T	T	T	T	T

74. Define Identity Law

Ans. Identity Law

If a variable is OR'ed with a False, the result is always equal to that variable. And if a variable is AND'ed with a True, the result is always equal to that variable.

c) A OR False = A, A variable OR'ed with False is always equal to that variable.

d) A AND True = A, A variable AND'ed with True is always equal to that variable.

75. Define logical expressions.

Ans. Logical Expressions

A logical expression is a combination of Boolean variables, Boolean Constants and the logical operators. We get a logical expression when some logical operator is applied to the Boolean propositions.

Example: (X+Y) + Z =X + (Y+Z)

Networks

Q.1: Define network

Ans. Network

An interconnected system of people or devices to share information and resources is known as a network. There are different types of networks around us; for example, transportation network,

Q.2: What is a computer network? Give an example.

Ans. Computer Network

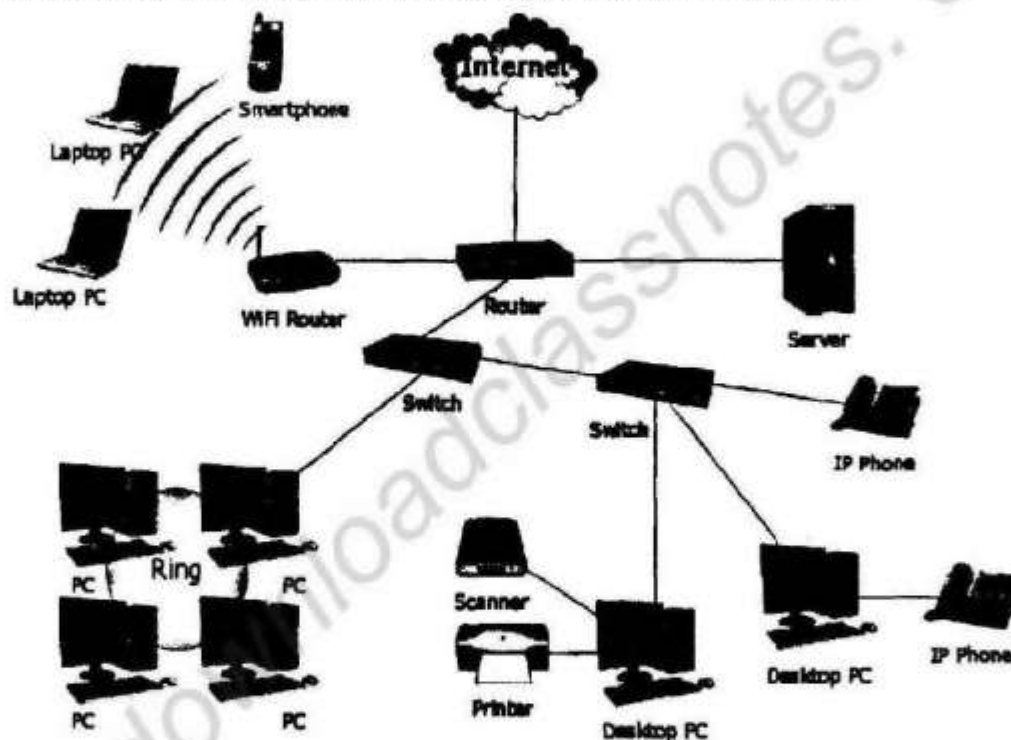
A computer network is a way of connecting two or more than two computers so that they can communicate with each other and share resources like printers, storage devices and important data etc. It is a mechanism that connects computers. Computer networks allow computer users to share expensive computer equipment for example, it would be costly to buy a separate laser printer for every personal computer in an office instead, devices like printers large storage disks can be shared by computer networks. We can set up simple computer network by connecting two computers with each other.

In our daily life, we use computers to browse the internet, send/receive emails, play online games, watch online videos, download music, take online courses, read daily newspapers, etc. All such activities require a computer connected with some other computer to make a computer network. They can be linked through a wire or wirelessly. A communication medium connecting multiple computers is also called a communication channel.

Overview of a Computer Network

Similarly, a computer network can also consist of hundreds of computers and devices around the world. Computer Networking is an important field of computer science. People around the world use computer networks every day in business, at home and at school, etc.

Example

Networks are connected together to make a larger network which is called network of networks. Internet is considered as the most well known example of network of networks. It allows millions of users in the world to share information.

Large Computer Network

Q.3: Describe the uses/need of a computer network.

Ans. Uses/Need of a computer Network

A computer network is established for the purpose of sharing resources. A computer network provides unique services and benefits to its users. Some of them are as follows:

(i) File Sharing

One of the most important use of networking is sharing of data. Networking allows thousands of users to share data much more easily and quickly. Networking of computers helps a network user to share files. For example, if you need date sheet of your board examination, you can get the file through the internet, without visiting BISE (Board of Intermediate and Secondary Education) office. Similarly, BISE requires your picture and

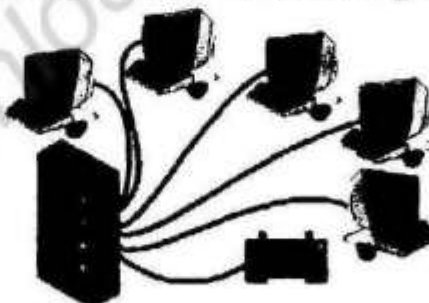
your bio data for admission form. They can get all these files over a network. So, the file sharing is helpful to complete a task systematically.

File Sharing

Example:

If all your school teachers want to prepare a combined result using computers, they can share files over a school network or the internet. Moreover, sharing files with others who are living in a different city or even country is also much helpful and is done in the same way.

(ii) Hardware Sharing

Network facilitates the sharing of hardware devices. Business and home users shares their hardware on the network to save money. Users can share devices such as printers, scanners, CD-ROM drives, hard disk drives etc. For example, in an office, usually there are less number of printers and scanners than the available number of computers. Using a network, these resources are shared to get a cost efficient solution.

Resource Sharing Example

(iii) Application Sharing

Applications can be shared over the network. It means that more than one users may use the same application. For example, in a bank; cashier, manager, ATM (Automated Teller machine) users use same application over the network. Bank balance updated at one point is updated for all branches immediately.

ATM

(iv) Sharing a single Internet connection

The Internet itself is a large network, so whenever we access the Internet, we are using a network. Multiple users can access Internet over a network. Using a network at

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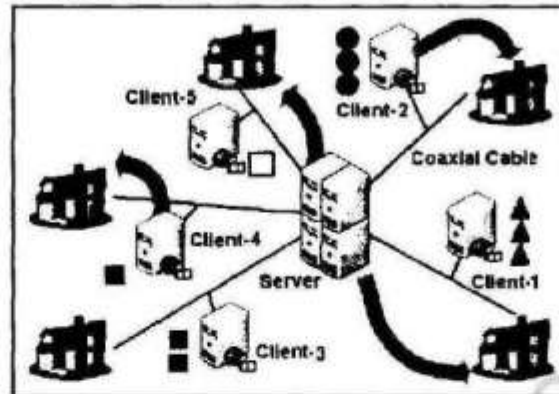
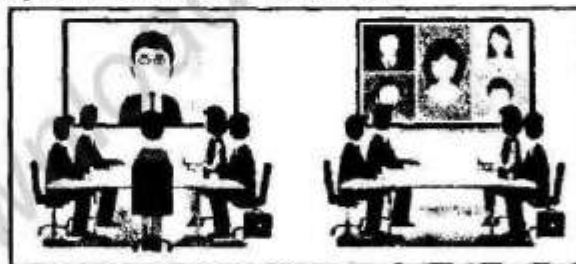
home or office, we can share one internet connection with more than one users.

Computer Network

(v) User Communication

People can communicate easily and efficiently with one another using computer networks. They can communicate using e-mails, newsgroups and video conferencing etc. So, communication with many people sitting on different locations is possible due to a computer network.

Example

A video conference comprises the technologies for the reception and transmission of audio/video signals by users at different locations.

Video Conference

(vi) Increasing storage capacity

Storage capacity means the limit to store data in a computer. If we connect our computer to another computer having more storage, then we can also use the disk space of that computer. In this way we can store and access files stored remotely. In this setup, a computer providing the storage is called file server and the computer accessing that space is called a workstation. We can use services like DropBox and Google Drive to store our files remotely.

(vii) Data Security and Management

In a business environment, a network allows the administrators to manage the company's critical data. Data can be maintained on shared servers. This makes it easy for everyone to find data. The administrator has full control, who can read or change critical information.

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(viii) Performance Enhancement

Under some circumstances, a network can be used to enhance the overall performance of some applications by distributing the computation tasks to various computers on the network

(ix) Entertainment

Networks allow users to access many types of games and entertainment. The Internet itself offers many sources of entertainment. Many multi-player games are available that operate over a local area network.

Q.4: What is meant by Client/Server network architecture? Explain it.

Ans. Client/Server Network Architecture:

Client/server architecture is a networking architecture in which many client computers request and receives the services from a centralized computer known as server. Server delivers, manages and controls network resources. This type of architecture has one or more client computers connected to a central server over a network or Internet connection.

When we access a website, we get contents on our screen served by a server. Our emails are also there on some server, and when we provide username and password, the server verifies credentials and serves our email records. An email user in this example is a client.

(i) Server

A computer that provides services to the computers and other devices connected to the network is known as server. A server is a physical dedicated to run services to serve the needs of its clients. Depending on the services that is running, it could be a file server, database server, print server or a web server. Server computers have large hard disks, high processing speed and sufficient memory. These are more expensive as compared to the client computers.

Different services provided by the server are as follows:

- Sharing hardware devices
- Sharing software
- Processing the data
- Managing network traffic
- Centralized storage for software, data and information.
- Control access to the hardware, software and data.

(ii) Client

A computer in the network that is connected with a server to access different resources is known as client. The client computer sends request to the server for resources. The server computer provides the requested resource to the client computer.

The client computer is less powerful than server computer. Clients rely on servers for resources, such as files, devices and even processing power.

A client is a process that accesses a service provided by a server. For example, to check email we use web browser as a client. The client provides a user interface to carry out actions, like giving username and password. It forwards requests to the server, which in return provides the required service. It is important to know whether a client is hardware or software. In general, a client is a hardware, but in particular the software running on that hardware is the process which makes it a client.

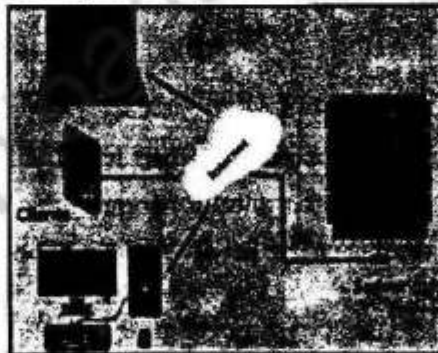
Advantages of Client/ Server Network Architecture

Some important advantages of client/server network architecture are as follows:

- It provides faster responses to the clients.
- It reduces the volume of data traffic on the network.
- It can use less powerful computers as clients because most of the processing is done by the server computer.

Disadvantages of Client/ Server Network Architecture

Some disadvantages of client/server network architecture are as follows:

- Client/server model is expensive because server computers are very costly.
- When server goes down, all the operations of the network stop.

Server Communication

Q.5: What is meant by physical structure of networks? Explain different types of connection.

Ans. Physical Structure of Networks or Network Architecture

The logical and structural layout of the network is called Physical structure of network or network architecture. It consists of hardware, software, connectivity, communication protocols and mode of transmission (wired or wireless). Basically it is the design of a network. Physical structure of networks can be classified in terms of type of connection and topology.

Types of Connection

Two devices can communicate with each other when they are connected in some

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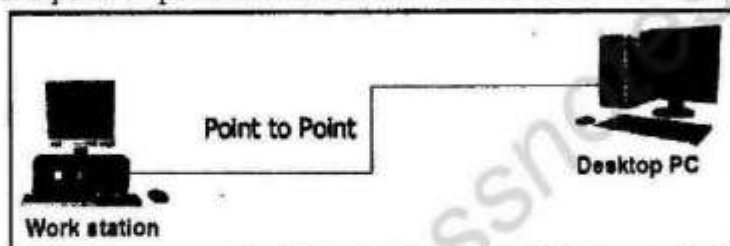
way to the same link at the same time. Point to point and multipoint are two possible types of connections.

(i) Point to Point Connection /Network

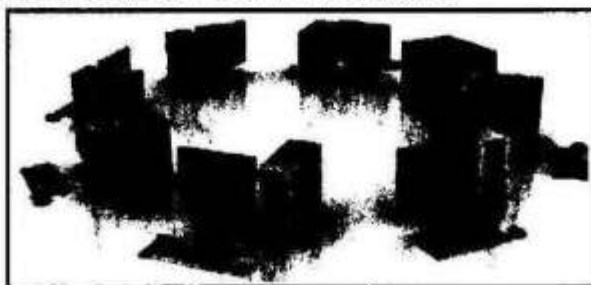
A point-to-point network is a simple network. It contains exactly two hosts (computers, servers, switches or routers) connected through a cable. Often, the receiving end of one host is connected to sending end of the other and vice-versa. If the hosts are connected point-to-point logically, then may have multiple intermediate devices. But the end hosts are unaware of underlying network and see each other as if they are connected directly. It is a direct link only between two devices i.e. a sender and a receiver. For example, there is a point to point connection between a remote control and a television.

Point to point network

(ii) Multipoint Connection/ Network

In multipoint connection, there is a link between a sender and multiple receivers. So, more devices can share a single link. For example, in a Wi-Fi based network a single link is shared among multiple devices.

Q.6: What is meant by Peer to Peer Network architecture? Explain it.

Ans. Peer to Peer Network

It is simplest and low cost network architecture. Normally, it consists of less than 10 computers. In this computer architecture each computer is called a peer. In peer to peer all computers are connected with each other, each computer serves as a client and as server too. In this network each computer can share the resources of the other computer. This type of architecture is ideal for the small businesses.

Peer to Peer Network

Advantages of Peer to Peer Network

Some advantages of peer to peer network architecture are as follows:

- It does not require expensive server computer.

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- It is easy to setup.
- It is suitable for small office of ten or less computers.
- It is easy to maintain.

Disadvantages of Peer to Peer Network

Some disadvantages of peer to peer network architecture are as follows:

- It provides less security of data.
- Heavy use can slow down the network speed.

Q.7: Describe different types of computer networks.

Ans. Types of Computer Networks

Computer networks are normally classified on the basis of area covered by them. There are three main types of network on the basis of geographical distance which are as follows.

- Local Area Network (LAN)
- Metropolitan Area Network (MAN)
- Wide Area Network (WAN)

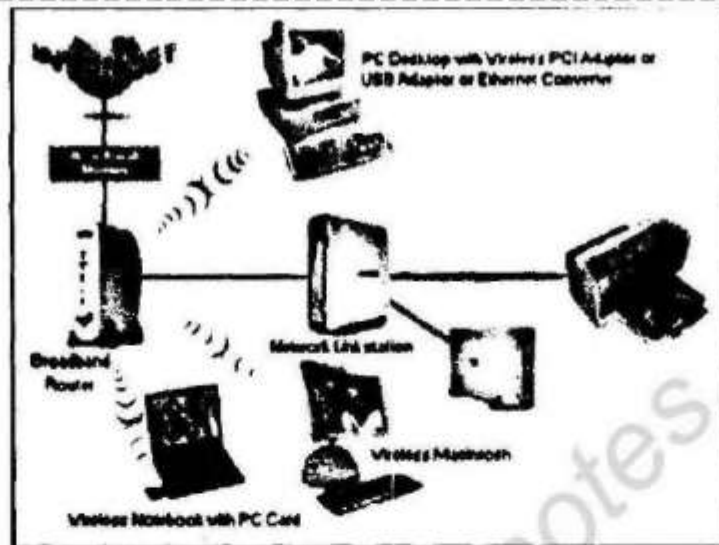
(i) Local Area Network (LAN)

LAN stands for Local Area Network. It connects computers and devices in a limited geographical area such as home, school, computer laboratory and office. In LAN, computers share printers, storage devices and different programs with one another. A LAN is the simplest form of network. In LAN typically one transmission medium is used. Its speed ranges from 10 Mbps to 1Gbps.In local area networks mostly twisted pair cable is used to connect devices.

LAN

Wireless LAN (WLAN)

We can also set up wireless LANs. This type of network is called Wireless Local Area Network (WLAN). In WLANs wireless medium and wireless network cards are used. WLANs allow users to move around while still connected with a local network.

There are different wireless standards used in WLANs. IEEE 802.1 is the most commonly used standard. It is also known as Wi-Fi. It has a limited range of connectivity ,50 to 300 feet. Wi-Fi signals can travel through from wall and other non metal barriers.

Wireless LAN

Examples

- The computer network in an office building
- The computer network in a school.

Advantages of LAN

There are lots of advantages of using LAN, some of them are as follows:

- The users can share different application software.
- The users can share hardware devices like printer, scanner, CD ROM and etc.
- Data can be saved on the central location.
- The users of the LAN can communicate with each other and transfer data to other users very easily.

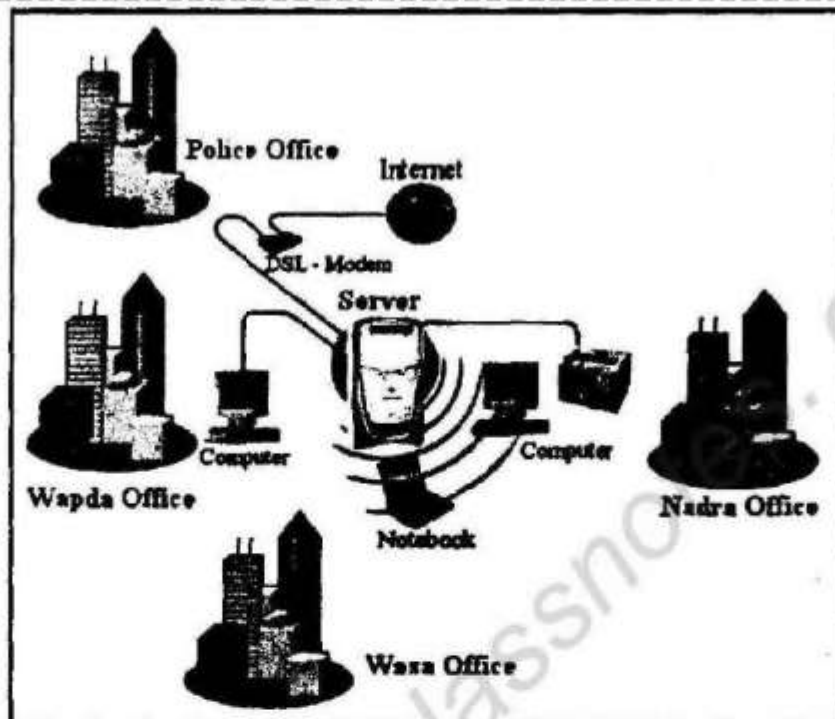
Disadvantages of LAN

Some disadvantages of using LAN are as follows:

- Technical persons (Network Manager) are required to maintain the LAN.
- It requires special security measures to stop unauthorized users.

ii) Metropolitan Area Network (MAN)

MAN stands for Metropolitan Area Network. It covers an entire metropolitan area such as large city. It connects two or more LANs. A metropolitan area network is designed to share resources of different LANs in a city. A MAN uses different transmission media (wired or wireless) and hardware for communication.

A MAN is normally maintained by a single organization or government agencies. Cable TV operators, ISPs and business organization use metropolitan area network to provide services to the users. For example an organization such as a bank can connect its different branches in a city through metropolitan area network.When we watch TV channels using cable TV Network we become a part of a metropolitan area network.

Metropolitan Area Network

Examples

Some examples of MAN are as follows:

- Cable TV network in a city
- The network of a school connecting different campuses in a city
- The network of company having different offices in a city

Advantages of MAN

Some advantages of MAN are as follows:

- It provides higher data transfer speed than LAN.
- It covers a larger area than LAN.

Disadvantages of MAN

Some disadvantages of MAN are as follows:

- MAN is difficult to maintain than LAN.
- It is expensive than LAN.

(iii) Wide Area Network (WAN)

WAN stands for Wide Area Network. It covers a large geographical area such as a country or around the world. WAN is normally used to connect multiple LANs and MANs at different locations. A WAN uses different transmission media (wired or wireless) and hardware for communication. WANs are used in large business networks. For example a bank has office in different cities around the world. It will set up LANs in each office and connect them through a WAN.

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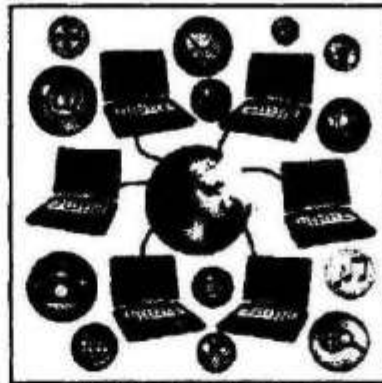

Wide Area Network

Examples

Some examples of WAN are as follows:

- The Internet is the best example of wide area network.
- The network connecting the ATMs of a bank.
- Network of NADRA

Advantages of WAN

Some advantages of WAN are as follows:

- Users can communicate with each other all over the world.
- Users can share ideas using internet which is the example of WAN.

Disadvantages of WAN

Some disadvantages of WAN are as follows:

- It is difficult to maintain.
- It is expensive than any other network.
- It is difficult to ensure the security in WAN.
- Source of virus

Q.8: What is network topology? Describe bus, star, ring and mesh topologies with a diagram of each.

Ans. Network Topologies

The layout of computers and devices in a network is called network topology. In simple words we can say that the way computers and devices are connected in a network is called network topology. It is a geometric representation of the relationship among the interconnected devices.

Types of Network Topologies

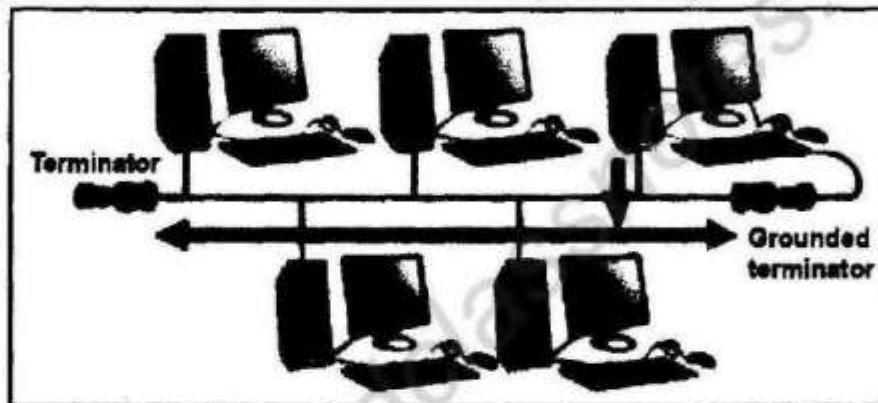
Different types of network topologies are as follows:

- Bus topology
- Star topology
- Ring topology
- Mesh topology

(i) Bus topology

In bus topology a main transmission line/cable is laid down in the center of the

network and all the devices and computers are connected to it. This line/cable is called backbone of the topology. The physical line is called bus that is why this type of network is called bus network or bus topology. Data travel through the center line until it reaches the required devices or computer. At both ends of line there are terminators that terminate the data when reaches the destination. One of the computer acts as a main server in this topology.

In this simple form of networking, failure of any single device does not affect other devices connected with the cable. However, if there is some problem in the shared communication cable, then all other devices can stop functioning.

Bus topology

Advantages of Bus Topology

Some advantages of bus topology are as follows:

- It is simple and less expensive.
- It is easy to install bus network topology.
- It requires small length of cable to connect computers.
- User can easily extend a bus network by joining more computers to the network.
- If one workstation/node fails, it does not affect the rest the network.

Disadvantages of Bus Topology

Some disadvantages of bus topology are as follows:

- It only supports small number of computers.
- The network speed slow down as the number of computers increases.
- It is difficult to troubleshoot.

(ii) Star topology

In star topology all devices and computers are connected to a central device like a router, switch or a hub, etc. Data is sent for the central device which then sends out data to desired host. In this topology if one device fails then the rest of the network is unaffected. On the other hand if central device breaks down the whole network breaks down.

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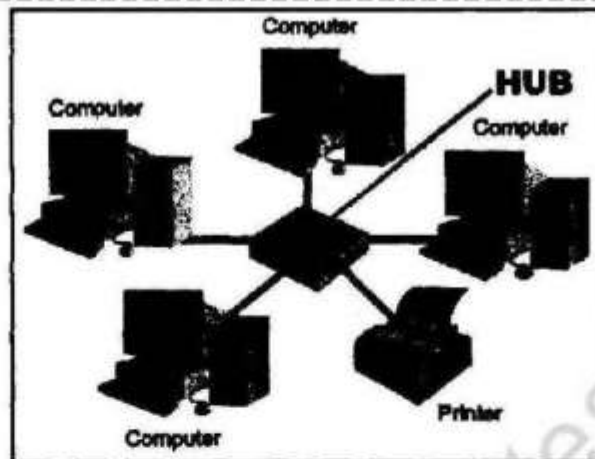
Star topology

For example, if a computer request for data, the central device will locate the data and route that data to the required destination. It is very popular and most used topology. In star topology the central device can be a computer server or a simple device like switch router, etc.

Advantages of Star Topology

Some advantages of star topology are as follows:

- In this topology new nodes are very easy to install.
- It is very easy to maintain the network.
- Easy to troubleshoot.
- It is more flexible than other topologies.
- Single computer failure does not bring down the whole network.

Disadvantages of Star Topology

Some disadvantages of star topology are as follows:

- It is more expensive.
- It requires more cable to connect to the server.
- If central hub fails, the entire network breaks down.

(iii) Ring topology

A ring topology connects a computer with exactly two other computers forming a ring of computers. A computer can send data to its immediate neighbour. A ring can be unidirectional or bidirectional. In a unidirectional ring topology, data is sent either clock wise or anti clock wise. In a bidirectional ring topology, data can travel in any direction. Upon receiving data, a computer may pass to its next neighbour. In this way, data reaches the desired destination. A failure of connection between two computers may down the whole network. Unlike star topology, it does not require a central device to manage the connectivity between the devices.

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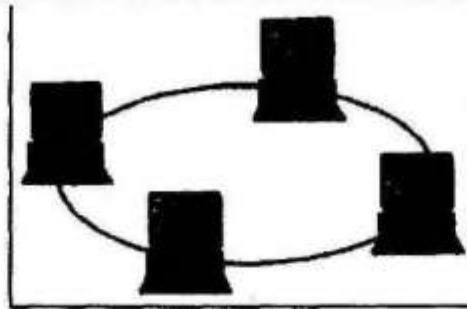

Ring topology

Advantages of Ring Topology

Some advantages of ring topology are as follows:

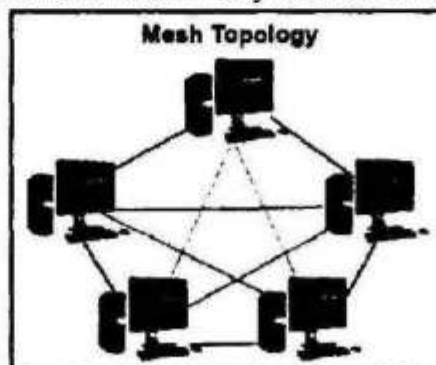
- It is less expensive than bus topology.
- It requires less cable to connect the computers to the server.
- Every computer has equal access to the network.

Disadvantages of Ring Topology

Some disadvantages of ring topology are as follows:

- It is difficult to troubleshoot.
- Adding or removing computers affects the whole network.
- Failure of one computer in the ring can affect the whole network.

(iv) Mesh topology

Mesh topology connects all devices with each other through a direct link. In this topology all hosts can also be connected to each other which is known as full mesh as shown in the fig. As compared to ring topology, the data may reach its destination quickly. Mesh topology is an expensive topology in terms of cable cost as it uses a lengthy cable to connect computers as compared to the cable used in other topologies. However, the mesh topology is more reliable as it offers point-to-point connection. It is also considered more secure as data travels only between a sender and a receiver.

Advantages of Mesh Topology

Some advantages of mesh topology are as follows:

- It is easy to troubleshoot.

- If one node on a mesh network fails, the network can still function.

Disadvantages of Ring Topology

Some disadvantages of ring topology are as follows:

- It is difficult to install and modify.
- A full mesh network can be very expensive.

Q.9: Define data communication. Explain the main components of communication system.

Ans. Data Communication

Data communications refers to exchange of messages between sending and receiving devices through some communication medium. These messages are actually the information which can be presented in many forms like text, numbers, images, audio and video. Your ability to pick up a phone and talk to any one in the world, send an image using a fax machine, send computer data just anywhere in the world are all examples of data communications.

Components of Data Communication:

A communication system is used to transfer data from one point to other. The process of data transmission has well defined steps and they are executed in a particular sequence. For example, if you want to send your picture from your computer or cell phone to someone else, you need a communication system. Basic components of data communications system are as follows:

- Sender
- Receiver
- Message
- Protocol
- Transmission Medium

(i) Sender

The device on a network that is used to send the data or signal to other connected device is called sender device. It is also called source/ Sender or transmitter. Sender is a device that initiates the communication process. It sends messages consisting of text, numbers, pictures etc. Normally, computer is used as a sender in a communication system.

(ii) Receiver

Receiver is a device that receives a message. It is also called sink. The receiver can be a computer, printer or another device. The receiver must be capable of accepting a message. Cellular Phone and Computer both can be sender as well as receiver.

(iii) Message

A message is the data or information that the sender wants to communicate to the

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receiver. The message might be a document having text, numbers, a picture, sounds, video or any combination of these.

In a data communication system, a message is sent in the form of packets. Each message has two parts, i.e. payload and control information. Payload is the actual contents of a message whereas the control information contains information about the sender and the receiver. Control information is also called header of a message. It is just like writing a letter where we write a letter along with the information about its sender and receiver. In this example, your letter is the payload. It requires the control information in order to dispatch and get a reply.

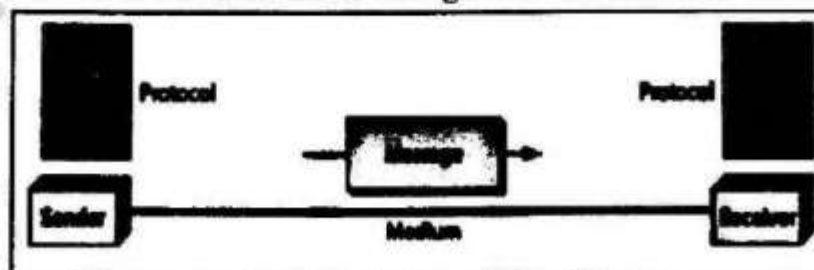
Example

Suppose you want to distribute your books of 8th class to different people. It is possible that the recipient of a book may write you a letter of thanks. You put a label on each book containing the destination address without any further instructions. In this example the label is a header also called control information and book itself is a payload also called message.

(iv) Protocol

A protocol is a formal agreement between two parties. A network protocol is a formal arrangement between two computers to send and receive information. Very specifically, a network protocol defines a set of rules and procedures for communication between a sender and a receiver. E.g. TCP/IP, HTTP and etc.

(v) Transmission Medium

Transmission medium is the physical path that is used to connect a sender and a receiver. The message travels through a transmission medium. A transmission medium might include telephone wiring, fiber optic cable, microwave or satellites. Transmission medium is also called a communication channel. Following figure shows that a message is transmitted from a sender to a receiver through some transmission medium.

Components of data communication

A device may use multiple channels at the same time. For example, if a cell phone is connected with the internet, it uses a data channel (3G/4G/LTE) for using the internet services and a voice channel for calling purpose.

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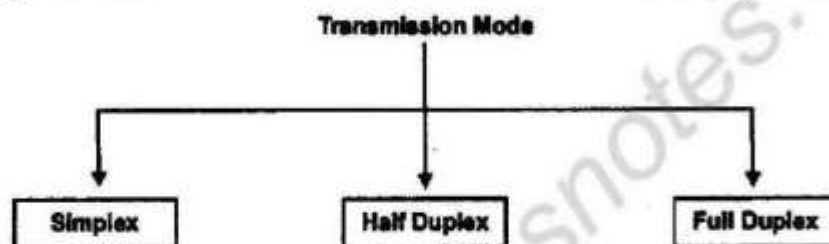
Q.10: What is data transmission mode? Explain its types with example.

Ans. Data Transmission Modes

The way data is transmitted from one place to another on a network is called data transmission mode. It is also called the data communication mode. It shows information flow direction. Sometimes, data transmission modes are also called directional modes.

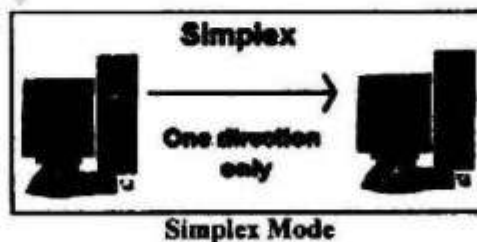
Types of Transmission Modes

There are basically three types of data transmission modes which are as follows:

- Simplex mode
- Half-duplex mode
- Full-duplex mode

(a) Simplex Mode

In simplex mode, data can flow in one direction only. In this mode, a sender can only send data and cannot receive it. Similarly, a receiver can only receive data but cannot send it.

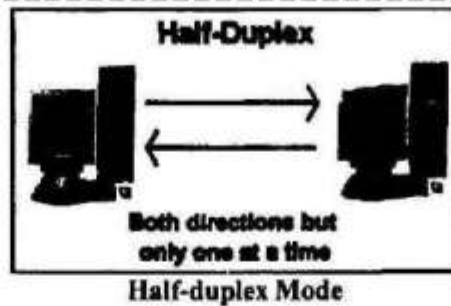
Example

- Data sent from computer to printer
- Radio transmission
- T.V. Broadcast

Simplex Mode

(b) Half-Duplex Mode

In half-duplex mode, data can flow in both directions but only in one direction at a time. In this mode, data is sent and received alternatively. The Internet browsing is an example of half duplex mode. The user sends a request to a Web server for a web page. It means that information flows from user's computer to the web server. Web server receive the request and sends data of the requested page.

Example

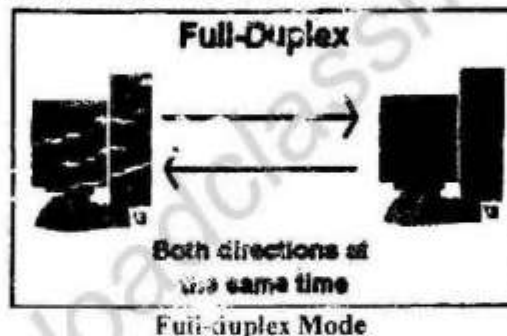
A walkie-talkie is an example of half-duplex device. It allows only one person to talk at a time. The second person receives the message when the first person talks.

Half-duplex Mode

(c) Full-Duplex Mode

In full duplex mode, data can flow in both directions at the same time. It is the fastest directional mode of data communication.

Example

The telephone communication system is an example of full-duplex communication mode. Two persons can talk at the same time.

Full-duplex Mode

Q.11: What are different technologies used in cellular communication?

Ans. Technologies used in cellular communication

Different technologies used in cellular communications are as follows:

(i) 2G Technology

It is a second generation technology. 2G is a faster cellular communication. It allows data and voice signal. Its speed is 512kbps to 1.4 mbps. It facilitates multiple users on a single channel. It was launched in Finland in the year 1991.

(ii) 3G Technology

3G is faster than 2G. Its speed is 512kbps to 1.4 mbps. It provides high speed mobile internet.

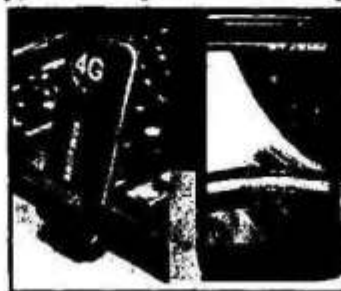
Advantages of 3G

- Overcrowding is relieved in existing systems with radio spectrum
- Bandwidth, security and reliability are more.
- Provides interoperability among service providers
- Availability of fixed and variable rates
- Support to devices with backward compatibility with existing networks
- Always online devices - 3G uses IP connectivity which is packet based
- Rich multimedia services are available

Disadvantages of 3G

- The cost of cellular infrastructure, upgrading base stations is very high
- Needs different handsets
- Roaming and data/voice work together has not yet been implemented
- Power consumption is high
- Requires closer base stations and are expensive
- Spectrum-license costs, network deployment costs and handset subsidies subscribers are tremendous.

(ii) 4G Technology

4G is ten times faster than 3G cellular communication. It gives lightening speed mobile Internet, video telephony, etc. Its speed is 200 mbps to 1 GB.

Advantages of 4G Technology

- Cellular providers have the opportunity to offer data access to a wide variety of devices
- Provides mobility
- More Flexible
- More Reliable

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- Easier to Standardize
- Offers Affordability

Disadvantages of 4G Technology

- Obtaining information from everyday people illegally becomes easier
- Involves the possibility of some interference though not much
- Capable of being attacked (jamming frequencies)
- Invasion of privacy increased

Q.12: What is communication line? Explain different communication lines.

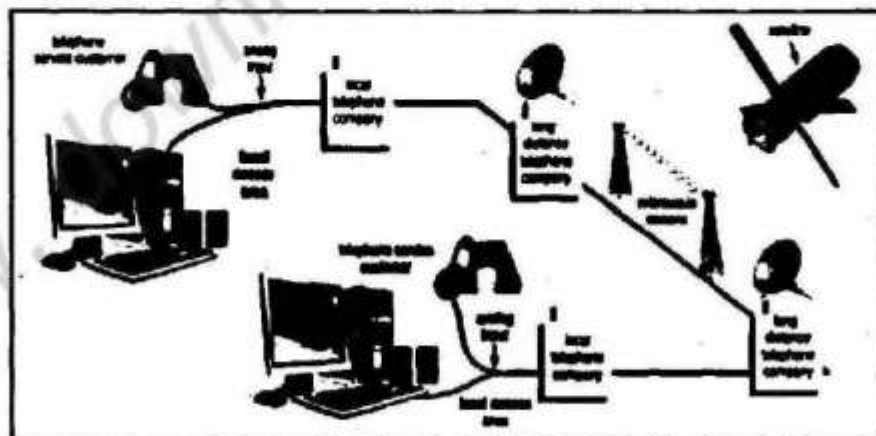
Ans. Communication lines

Communication lines allow us to communicate over a computer network.

Types of Communication lines

The different types of communication lines which use telephone network for data communications are as follows.

(i) Dial-up line

Dial-up line is a technology that helps a user to connect the Internet using standard telephone lines. A user can access Internet by plugging in telephone line in the modem. When a user initiates a dial-up connection, the modem dials a phone number of an Internet Service Provider (ISP) that is designated to receive dial-up call. Once the connection made the two computers can communicate with each other. It is a slow speed and inexpensive technology. In this type of connection telephone line remains busy and one cannot make calls.

Dial-up lines

(ii) Digital Subscriber Line (DSL)

DSL is a communications line used to transfer digital signals over standard telephone lines. DSL is a high speed technology. It is one of the fastest and affordable connections. In order to access the Interest using DSL, a user must connect to a DSL Internet service provider (ISP).

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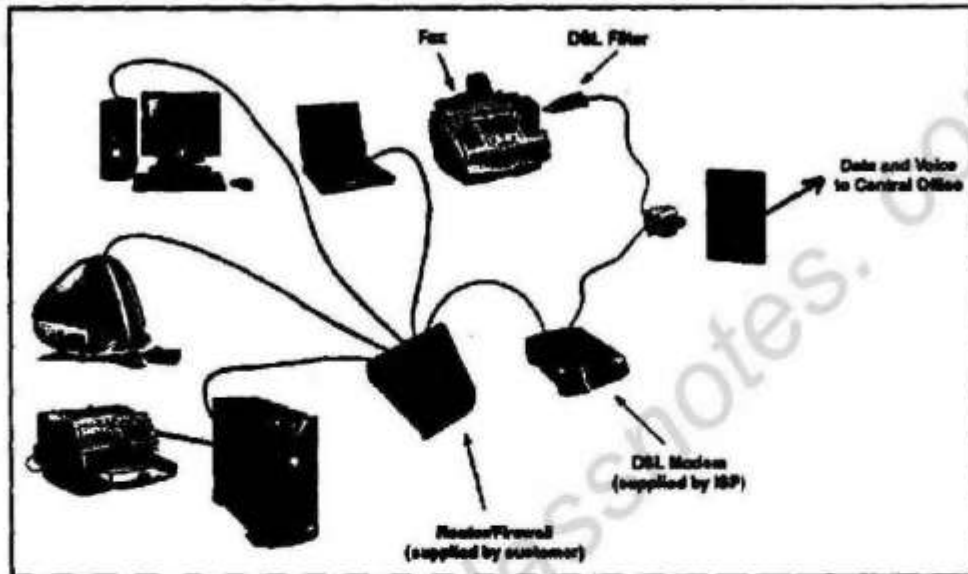
The ISP will provide a DSL modem, which can be connected to either a router or a computer. Some DSL modems have built in routers which allow to access Internet through Wi-Fi. In DSL telephone line remains free one can easily dial and receive calls.

DSL lines

(iii) Integrated Services Digital Network lines (ISDN)

ISDN (Integrated Services Digital Network) lines are a standard for sending digital data over standard telephone lines. It is used for home and small business. It provides faster data rate than a dial up line. In ISDN a telephone wire can carry three or more signals (data, voice and video) at a time. In ISDN lines we need two ISDN modems one on the sending end and other on the receiving end. Both ISDN modem should be within the range of 3.5 miles to establish a connection.

ISDN Lines

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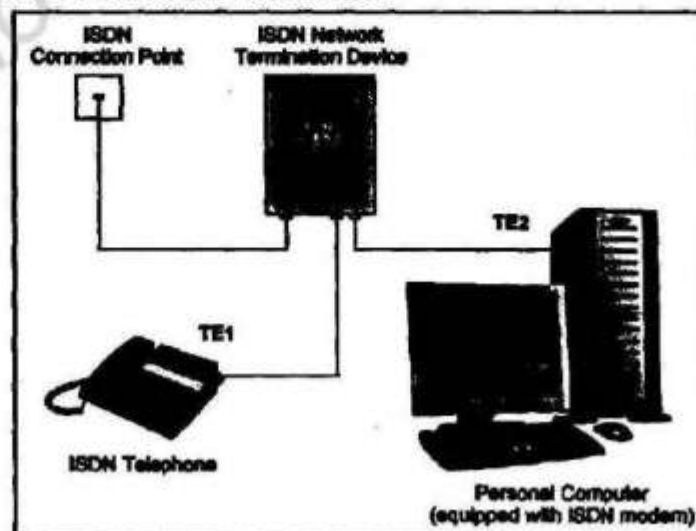

Q.13: What is TCP/IP? Describe its five layers with their functions.

Ans. TCP/IP

The whole communication process is carried out in different layers, where each layer performs one or more specific tasks. The internet also uses a layered communication model, called the Transmission Control Protocol/Internet Protocol (TCP/IP) model. The TCP/IP is a suit of protocols that provides end to end connectivity between devices.

Layers of TCP/IP

Transmission Control Protocol/Internet Protocol (TCP/IP) consists of five layers.

- Application layer
- Transport layer
- Network layer
- Data link layer
- Physical layer

Application	Application
	Presentation
	Session
Transport	Transport
Network	Network
Data Link	Data Link
Physical	Physical

The concept of layering can be explained with post office example. Suppose you are in Lahore and want to write a letter to your friend in Islamabad. After writing the letter, you insert it in an envelope, write address of your friend on it and drop it in a mailbox. As there may be many people living at the same address, so you write the name of your friend on the envelope. Your nearest post office takes the letter to general post office in Lahore which sends the same to general postal office in Islamabad. Ultimately, the letter reaches at the address and then to your friend. Then he/she can read the message and write a reply. Here we relate this example with the layered network model of TCP/IP. Assume that two persons are chatting a computer network.

Postal System	Layered Network
In writing a letter, you consider only writing proper message without concerning about the names of the post office staff who will handle the envelope. Moreover, you do not need to know the details of the mail delivery system.	While chatting you are concerned only about the messages without bothering about the kind of network, i.e. wireless or wired. This is called application layer where you type a message and send on the network.

You simply put it in an envelope and write the street address.	The address of the receiving device is provided in the form of header before message content.
You write sender and receiver information over the envelope and put it in the letter box. If the address is incomplete, you may get your letter back. If everythink is fine, you simply trust on the postal system.	**Transport layer** establishes connection between a client and a server. It tries to send message but if there is some error like your computer is disconnected from the network then it informs the application program. If the network is fine, the application trust the transport layer that the message will reach at its destination.
The name of the specific person is mentioned who can open and read the letter.	At this stage, port number is added with message header for indication of specific application at destination. A port number is used to identify the application which can accept a message.
A letter is moved to other city (Islamabad in this example) by road or air.	A program running on the **network layer** moves the data to the other network. So, a chat message is transferred to other Wi-Fi router of your friend from where it is delivered to your friend and he/she can see it on screen.
Handling of letter is same either if they are letters with photographs, Eid card or containing text, etc.	A network handles all messages in the same way either if they are emails, pictures or voice messages etc.
Bikes or vans may carry your letter from letterbox to general post office.	**Data link layer** sends a message to the server connected with sender. If you are chatting at home with a Wi-Fi connection, then the data link layer sends message from your computer to the Wi-Fi router.
For you letter delivery, there is usage of roads, train tracks and may be airlines.	**Physical layer** is about the physical medium used in communication, like cabling etc.

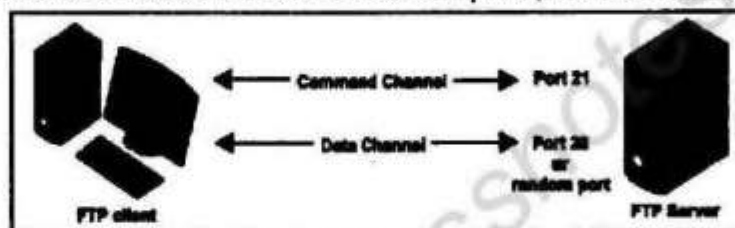
Each layer adds some control information called header with the data received from the layer above it. The actual content of message called payload, is hidden inside the header at each layer, like a letter is hidden inside an envelope. This is called encapsulation.

Q.14: Explain the protocols in TCP/IP suit.

Ans. Protocols in TCP/IP suit

TCP/IP stands for Transmission Control Protocol/Internet Protocol. Each layer of TCP/IP model has its own protocol(s). Every protocol is designed to perform some specific task. Some of the most widely used application layer protocols are as follows:

- **FTP**

FTP stands for File Transfer Protocol. FTP is the standard TCP/IP protocol which is used for the purpose of transferring files from one computer to another. For example, if we want to transfer a document file to a remote computer, then we can use FTP protocol.

Transferring Files over Network

- **HTTP**

HTTP stands for Hypertext Transfer Protocol. HTTP is a protocol used by World Wide Web (WWW) to transfer webpages between a client and a web server. A web server is also called an HTTP server. We use this protocol while browsing internet. For secure data transfer, we use HTTPS.

- **SMTP**

SMTP stands for Simple Transfer Protocol. SMTP is a standard protocol to transmit emails.

Q.15: Write a note on the following.

(a) Need for addressing

(b) Importance of addressing in data communication

Ans. (a) Need for Addressing

A packet is the unit data sent from one device to another. It requires its destination address just like we write address on an envelope while sending a letter. An application running on the recipient side accepts packets and assembles them to show a meaningful information. If there are more than one applications ready to accept a packet, then a number called port number distinguishes the targeted application from the other applications. So, proper addressing is required for reliable data transfer.

(b) Importance of addressing in data communication

Before sending a message, source must know the destination address. Devices on a network need addresses in order to communicate with each other. So, giving an address

to a message is the first step and the second step is to transmit the packet to its intended recipients.

Q.16: How telephone addressing relate with network addressing?

Ans. Mapping between Telephone Addressing and Network Addressing

Suppose you want to make a phone call to your friend. Before calling, you need to know exact telephone address that is the telephone number of your friend. On the internet, the telephone number corresponds to an IP address (Internet Protocol). Like a telephone number, all IP addresses are unique. Each device gets its own unique IP address when it gets connected to the internet. If an IP address of a device is fixed in a network, it is called static IP address. Otherwise if each time a new connection is made a new IP address is assigned, it is called dynamic IP address.

Q.17: How client and server communicate with each other?

Ans. Communication between a Client and Server

The World Wide Web (WWW) is a system of internet servers. Servers serve a request sent by a client. This request is called HTTP request. So, the communication between a server and a client is based on requests and their respective responses. Using a web browser when you type a URL (Uniform Resource Locator) like http://www.pakistan.gov.pk, you are sending a request. In its response you get the contents of website that may contain text, images, sounds, etc. These contents are embedded in an HTML (Hypertext Markup Language). In this case, your computer works as HTTP client, whereas the computer serving you a webpage is called HTTP server or web server as shown in the following figure.

HTTP Request and Response

Web browsers are used to access the World Wide Web (WWW) in an easy manner. Web browsers and web servers function together as a client server system. Client-server is a standard method for designing applications where data is kept in central locations (server computers) and efficiently shared with any number of other computers (the client) on request.

Q.18: What are the sizes of IPv4 and IPv6? Explain the method to calculate the size of these both standards.

Ans. IP Addressing

IP address stands for Internet Protocol address. It is a unique identifier that is associated with a device when it is connected to a network. An IP address is assigned by

a Dynamic Host Configuration Protocol (DHCP) server.

Standards of IP Addressing

There are two standards of IP addressing:

1. IPv4 addressing
2. IPv6 addressing

Example

- IPv4 address is like: 172.16.54.1
- IPv6 address is like: 2001:db8:0:1234:0:567:8:1

1- IPv4 Addressing

When the Internet Protocol was originally designed, the standard was known as Internet Protocol Version 4 (IPv4). As shown in the above example, the IPv4 is divided in four groups separated by '.' where each group can contain a decimal value from 0 to 255. After the conversion from decimal to binary, we get $(255)_{10} = (11111111)_2$. It shows that maximum 8 bits are required for every group of IPv4. So, in total 32 bits are required to store the whole IP address in IPv4 standard.

2- IPv6 Addressing

Due to more and more devices connecting to the internet, IPv4 addresses are running out. To accommodate the increase in devices, another standard of IP addressing is introduced which is called Internet Protocol Version 6 (IPv6). It consists of 128 bits. In IPv6, there are 8 groups separated by ':' , as shown in the above example. Each group can contain 4 hexadecimal digits. To store one hexadecimal digit, we need 4 bits. So, for a group in IPv6 we need 16 bits and for 8 groups total 128 bits are required.

- 1 hexadecimal digit requires 4 bits.
- 4 hexadecimal digits require 16 bits.
- 1 group has 4 hexadecimal digits, so each group requires $4 \times 4 = 16$ bits.
- 8 groups require $8 \times 16 = 128$ bits.

Although IPv4 is still in use today and provides approximately 4.3 billion addresses, however this number is less than the population of the whole world. We also know that nowadays many persons have more than one devices connected with the Internet at a time. IPv6 can allow up to 2^{128} addresses which is 7.9×10^{28} times more than the number of addresses in IPv4.

IPv6 was developed by the Internet Engineering Task Force (IETF). IPv6 became a Draft Standard in December 1998, and became an Internet Standard on 14 July 2017.

Q.19: What is router? Explain the routing process.

Ans. Router

A router is a networking device that forwards data packets from one network to another. As the internet is called network of networks, so a router also directs the traffic on the internet.

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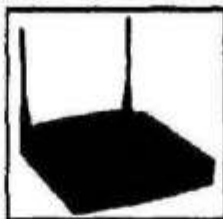

Router

A router analyses the destination IP address of an incoming data packet, determines the best route to forward the packet, and then sends it accordingly. A router is usually placed at the meeting point of two or more networks.

Routing in the Internet

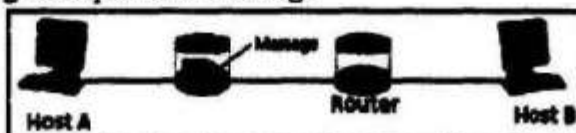
We get the internet service from some Internet Service Provider (ISP). When we send a request from a device it reaches an ISP where router is installed.

Usage of Router

The router forwards our request according to header of our message. For communication over the internet, there may be hundreds of networks between the source and the destination. Hundreds of routers might forward a single packet as it moves from one network to the next on the way to its final destination.

Routing Process

Routing is a process of taking data from one device and sending it to another device on a different network. Every data packet has two addresses, destination address and source address. Destination address is used to deliver the data packet at destination. Source address is used to identify the sender device.

Consider the following example of IP routing.

Message Routing between Source and Destination

Host A wants to communicate with host B, but host B is another network. Host A is configured to send all packets destined for remote networks to the router. The router receives the packets, checks the routing table to see if it has an entry for the destination

address. A routing table is used by routers to determine the path to the destination network. If the entry exists for the destination address, the router forwards the packet out of the appropriate interface port. If the router does not find the entry, it discards the packet.

Summary

- A computer network, is a digital telecommunication network which allows nodes to share resources.
- A client computer is an individual computer that accesses the information and programs stored on a server as a part of a network environment.
- A server is a computer program or a device that provides functionality for other programs or devices, called "clients".
- Sender is a device that initiates the communication process. It sends message consisting of text, numbers, pictures, etc.
- Receiver is a device that receives message. It is also known as sink.
- The message is the data or information to be communicated. Message is of various data types such text, number, picture, sound and video.
- Rules are defined for the communication between sender and receiver called protocol.
- Medium is the physical path that connects sender and receiver.
- IP stands for Internet Protocol and is an address used for identifying number that is associated with a specific computer when it connects to the internet, it may be static or dynamic.
- A router is a networking device that forwards data packets from one network to another.
- Routing is a process of taking data from one device and sending it to another device on a different network.
- Network topology is the physical arrangements of devices and connecting lines.
- A network port is used to identify an application going to receive a message.
- TCP/IP is a stack of protocols and it has 5 layers.
- FTP is File Transfer Protocols which is used to transfer file over a network.
- A router directs messages on the internet.
- For home user, the internet service is provided by an ISP (Internet Service Provider).

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SOLVED EXERCISE

3.1 Choose the correct option.

1. The IPv4 address is made up of _____ binary bits.
(i) 31 (ii) 29 (iii) 32 (iv) 30

2. Routing is process of taking data from one device and sending it to another device in different _____ .
(i) Channel (ii) Network (iii) Path (iv) Area

3. DHCP stands for _____
(i) Data Hosting Computer Protocol (ii) Dynamic Host Computer Protocol
(iii) Dynamic Host Configuration Protocol
(iv) None of the above

4. Communications protocols cover _____ .
(i) Authentication (ii) Error detection (iii) Correction (iv) Above all

5. The receiver must be capable of accepting the _____.
(i) Protocol (ii) Message (iii) Address (iv) Information

Answers:

1. 32 2. Network 3. Dynamic Host Configuration Protocol
4. Above all 5. Message

3.2 Fill in the blanks.

1. A _____ is a computer device that accesses a service made available by a server.
2. _____ allow users to communicate using e-mail, newsgroups, etc.
3. Web browsers and web servers function together as a _____ system.
4. A protocol defines __ and ___ for communication between a sender and a receiver.
5. Routers connect multiple _____ together.
6. Every data packet has an _____ addresses.
7. IP addressing must be understood as part of the _____ for conversations over the Internet.
8. Email stands for _____ .
9. In a computer network, devices are connected through communication _____ .
10. A _____ accesses a service made available by a server.

Answers:

1. Client 2. Mail Server 3. Client/Server 4. Rules and Regulations
5. Networks 6. IP 7. Protocol 8. Electronic Mail
9. Channels 10. Client

3.3 Write short answers.

1. How client and server communicate with each other?

Ans. See question no. 4

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2. What are the main components of communication?

Ans. See question no.9

3. How telephone addressing relate with network addressing?

Ans. See question no. 16

4. What is the difference between static and dynamic IP?

Ans. See question no.16

5. Define communication channel.

Ans. Communication Channel/Transmission Medium

Transmission medium is the physical path that is used to connect a sender and a receiver. The message travels through a transmission medium. A transmission medium might include telephone wiring, fiber optic cable, microwave or satellites. Transmission medium is also called a communication channel.

A device may use multiple channels at the same time. For example, if a cell phone is connected with the internet, it uses a data channel (3G/4G/LTE) for using the internet services and a voice channel for calling purpose.

6. Describe the working of web browser.

Ans. See question no.17

7. What is the difference between point-to-point and multipoint connection?

Ans. See question no.5

8. What is application sharing? Answer with the help of an example.

Ans. Application Sharing

Applications can be shared over the network. It means that more than one users may use the same application. For example, in a bank; cashier, manager, ATM (Automated Teller machine) users use same application over the network. Bank balance updated at one point is updated for all branches immediately.

9. What are the advantages and disadvantages of star topology over bus topology?

Ans. See question no.8

10. In a client server model, is client software or hardware? Give reasons to support your answer.

Ans. Client

A client is a process that accesses a service provided by a server. For example, to check email we use web browser as a client. The client provides a user interface to carry out actions, like giving username and password. It forwards requests to the server, which in return provides the required service. It is important to know whether a client is hardware or software. In general, a client is a hardware, but in particular the software running on that hardware is the process which makes it a client.

3.4 Answer the following questions.

1. What is network topology? Describe bus, star, ring and mesh topologies with a diagram of each.

Ans. See question no.8

2. What is TCP/IP? Describe its five layers with their functions.

Ans. See question no. 13

3. What are the advantages and disadvantage of star topology over bus topology?

Ans. See question no.8

4. What are the sizes of IPv4 and IPv6? Explain the method to calculate the size of these both standards.

Ans. See question no. 18

Objective Type Questions

☆ Choose the correct answer:

1. It is used to share resources among computers:
(a) System (b) Network (c) Hardware (d) Software

2. We can share hardware and software using a:
(a) Communication device (b) Sender
(c) Network (d) Receiver

3. Modems, network cards and switches are:
(a) Communication devices (b) Receiving devices
(c) Transmission medium (d) Wireless Technology

4. On a network, a computer which works as a host is called a:
(a) Client (b) Router (c) Server (d) Switch

5. It is a type of a computer architecture:
(a) Peer to peer (b) Peer to point (c) Server/Point (d) Client to client

6. Which of the following is a computer device that accesses a service made available by a server?
(a) Client (b) Network (c) Sender (d) Receiver

7. Web browsers and web servers function together as a _________ system.
(a) Multipoint (b) Peer to Peer (c) Print Server (d) Client/Server

8. A network that connects computers within a building is:
(a) WAN (b) MAN (c) LAN (d) CAN

9. The internet is the best example of:
(a) LAN (b) WAN (c) MAN (d) CAN

10. **MAN stands for:**
    (a) Main area network (b) Mobile area network
    (c) Metropolitan area network (d) Major area network
11. **It is known as conversion of the analog signal to digital signal:**
    (a) Demodulation (b) Modulation (c) Communication (d) Transmission
12. **It is known as conversion of the digital signal to analog signal:**
    (a) Demodulation (b) Modulation (c) Communication (d) Transmission
13. **________ allow users to communicate using e-mail, newsgroups, etc.**
    (a) Client (b) Mail Server (c) Print Server (d) Receiver
14. **Which of the following is the physical arrangement of devices and connecting lines?**
    (a) Network topology (b) Medium
    (c) Protocols (d) IP
15. **In this topology transmission line is laid down in the center of the network:**
    (a) Ring (b) Star (c) Bus (d) Mesh
16. **This topology is expensive and difficult to install:**
    (a) Mesh (b) Star (c) Bus (d) Ring
17. **Which of the following defines by the protocol for communication between a sender and a receiver?**
    (a) Rules (b) Regulations (c) Both of above (d) None of above
18. **It is the fastest communication line:**
    (a) CDMA (b) DSL (c) 4G (d) ISDN
19. **It is a centralized computer in a computer network:**
    (a) Point (b) Client (c) Server (d) Peer
20. **The servers which manage disk drives are called:**
    (a) Print Server (b) Network server (c) File Server (d) Web server
21. **LAN stands for:**
    (a) Local Automatic Network (b) Local Area Network
    (c) Low Area Network (c) Load area Network
22. **In this connection telephone line remains busy:**
    (a) DSL (b) ISDN (c) Dial-up (d) CDMA
23. **Email stands for:**
    (a) Electronic Mail (b) Electrical Mail
    (c) Electronic Merge (d) Electronics Mail
24. **The Sender sends message consisting of:**
    (a) Text (b) Numbers (c) Pictures (d) All of These
25. **Receiver is also known as:**
    (a) Sink (b) Source (c) Transmitter (d) Destination

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26. **Sender is also known as:**
 (a) Source (b) Transmitter (c) Both of above (d) None of above
27. **Which of the following is the data or information to be communicated?**
 (a) Sink (b) Source (c) Transmitter (d) Message
28. **Which of the following is the physical path that connects sender and receiver?**
 (a) Message (b) Medium (c) Transmitter (d) Sink
29. **The computer or devices which send data are known as:**
 (a) Receiver (b) Sender (c) Message (d) Transmission Media
30. **The computer devices which receives data are known as:**
 (a) Receiver (b) Sender (c) Message (d) Transmission Media
31. **Wire media transmits data through a:**
 (a) Cable (b) Light (c) Radio Waves (d) Air
32. **In a computer network, devices are connected through communication:**
 (a) Protocols (b) Addresses (c) Channels (d) Servers
33. **IP stands for:**
 (a) Internal Protocols (b) Intranet Protocols
 (c) Internet Protocols (d) Internet Provider
34. **Which of the following is used to identify an application going to receive a message?**
 (a) Network Port (b) Medium (c) Channel (d) FTP
35. **The Internet is a type of:**
 (a) WAN (b) LAN (c) MAN d) VAN
36. **In simplex mode data flow in:**
 (a) Both direction (b) both direction in different time
 (c) Both direction simultaneously (d) one direction
37. **Every data packet has an ________ address.**
 (a) IP (b) FTP (c) HTTP (d) SMTP
38. **TCP/IP is a stack of protocols and it has ________ layers.**
 (a) 2 (b) 3 (c) 4 (d) 5
39. **FTP stands for:**
 (a) File Transmission Protocols (b) File Transfer Protocols
 (c) Final Testing Protocols (d) Final Target Provider
40. **ISP stands for:**
 (a) Internet Service Protocol (b) Internet Service Provider
 (c) Internal Service Protocol (d) Internal Service Provider
41. **Routers connect multiple ________ together.**
 (a) Clients (b) Servers (c) Users (d) Networks
42. **________ is a process of taking data from one device and sending it to another device on a different network.**
 (a) Routing (b) Sink (c) FTP (d) None of these

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Answers:

1. Network	**2.** Network	**3.** Communication devices	
4. Server	**5.** Peer to peer	**6.** Client	**7.** Client/Server
8. LAN	**9.** WAN	**10.** Metropolitan area network	
11. Modulation	**12.** Demodulation	**13.** Mail Server	
14. Network topology	**15.** Bus	**16.** Mesh	**17.** Both of above
18. 4G	**19.** Server	**20.** File Server	
21. Local Area Network		**22.** Dial-up	**23.** Electronic Mail
24. All of These	**25.** Sink	**26.** Both of above	**27.** Message
28. Medium	**29.** Sender	**30.** Receiver	**31.** Cable
32. Channels	**33.** Internet Protocols	**34.** Network Port	**35.** WAN
36. one direction	**37.** IP	**38.** 5	
39. File Transfer Protocols		**40.** Internet Service Provider	
41. Networks	**42.** Routing		

☆ Give short answers:

1. Define Computer Network

Ans. Computer Network: A computer network is a way of connecting two or more than two computers so that they can communicate with each other and share resources like printers, storage devices, important data etc. Internet is the best example of the computer network.

2. Write down the uses/need of a computer network.

Ans. Uses/Need of a computer Network

Some uses of a computer network are as follows:

(i) File Sharing (ii) Hardware Sharing
(iii) Application Sharing (iv) User Communication

3. What is meant by user communication?

Ans. User Communication: People can communicate easily and efficiently with one another using computer networks. They can communicate using e-mails, newsgroups and video conferencing etc. So, communication with many people sitting on different locations is possible due to a computer network.

4. Define communication device.

Ans. Communication Device: Communication devices are used to transmit and receive data from one user to the other users. It is also used to gain access to electronic information resources. E.g. Dialup modem, Network card, Router, Switch.

5. What is video conference?

Ans. Video conference: A video conference comprises the technologies for the reception and transmission of audio/video signals by users at different locations.

6. What services are offered by computer network to store files remotely?

Ans. We can use services like DropBox and Google Drive to store our files remotely.

7. What is the difference between file server and a workstation?

Ans. In a network environment a computer providing the storage is called file server and the computer accessing that space is called a workstation.

8. How the performance of an application is enhanced in a network?

Ans. Performance Enhancement: Under some circumstances, a network can be used to enhance the overall performance of some applications by distributing the computation tasks to various computers on the network.

9. What is meant by Client/Server network architecture?

Ans. Client/Server: Client/server architecture is a networking architecture in which many client computers request and receives the services from a centralized computer known as server. Server delivers, manages and controls network resources. This type of architecture has one or more client computers connected to a central server over a network or Internet connection.

10. What is server?

Ans. Server: A computer that provides services to the computers and other devices connected to the network is known as server. A server is a physical computer dedicated to run services to serve the needs of its clients.

11. What are the types of server?

Ans. Types of server: Depending upon the services that are running in a network, it could be a file server, database server, print server or a web server. Server computers have large hard disks, high processing speed and sufficient memory.

12. Write down different services provided the server in network environment.

Ans. Different services provided by the server are as follows:

- Sharing hardware devices
- Sharing software
- Processing the data
- Managing network traffic
- Control access to the hardware, software and data.

13. What is client?

Ans. Client: A computer in the network that is connected with a server to access different resources is known as client. The client computer sends request to the server for resources. The server computer provides the requested resource to the client computer. The client computer is less powerful than server computer. Clients rely on servers for resources, such as files, devices and even processing power.

14. Write down advantages of client/server network.

Ans. Advantages of Client/ Server Network: Some important advantages of client/server network architecture are as follows:

- It provides faster responses to the clients.

- It reduces the volume of data traffic on the network.
- It can use less powerful computers as clients because most of the processing is done be the server computer.

15. Write down disadvantages of client/server network.

Ans. Disadvantages of Client/ Server Network

Some disadvantages of client/server network architecture are as follows:

- Client/server model is expensive because server computers are very costly.
- When server goes down, all the operations of the network stop.

16. What is meant by physical structure of networks?

Ans. Physical Structure of Networks or Network Architecture: The logical and structural layout of the network is called Physical structure of network or network architecture. It consists of hardware, software, connectivity, communication protocols and mode of transmission (wired or wireless). Basically it is the design of a network. Physical structure of networks can be classified in terms of type of connection and topology.

17. Write down the types of network architecture.

Ans. Types of Connection/ Network: There are two types of network architecture or connections, which are as follows:

(i) Point to point connection (ii) Multipoint connection

18. What is meant by Point to Point Connection /Network?

Ans. Point to Point Connection /Network: A point-to-point network is a simple network. It contains exactly two hosts (computers, servers, switches or routers) connected through a cable. Often, the receiving end of one host is connected to sending end of the other and vice-versa. For example, there is a point to point connection between a remote control and a television.

19. Define Multipoint Connection/ Network

Ans. Multipoint Connection/ Network: In multipoint connection, there is a link between a sender and multiple receivers. So, more devices can share a single link. For example, in a Wi-Fi based network a single link is shared among multiple devices.

20. Define Peer to Peer Network architecture.

Ans. Peer to Peer Network: It is simplest and low cost network architecture. Normally, it consists of less than 10 computers. In this computer architecture each computer is called a peer. In peer to peer all computers are connected with each other, each computer serves as a client and as server too. In this network each computer can share the resources of the other computer.

21. Write down some advantages of Peer to Peer Network.

Ans. Advantages of Peer to Peer Network: Some advantages of peer to peer network

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architecture are as follows:

- It does not require expensive server computer.
- It is easy to setup.
- It is easy to maintain.

22. Write down some disadvantages of Peer to Peer Network.

Ans. Disadvantages of Peer to Peer Network: Some disadvantages of peer to peer network architecture are as follows:

- It provides less security of data.
- Heavy use can slow down the network speed.

23 .Write down different types of computer networks.

Ans. Types of Computer Networks: There are three main types of network on the basis of geographical distance which are as follows.

- Local Area Network (LAN)
- Metropolitan Area Network (MAN)
- Wide Area Network (WAN)

24. What is Local Area Network (LAN)?

Ans. Local Area Network (LAN): LAN stands for Local Area Network. It connects computers and devices in a limited geographical area such as home, school, computer laboratory and office. In LAN, computers share printers, storage devices and different programs with one another.

25. Define Metropolitan Area Network (MAN)

Ans. Metropolitan Area Network (MAN): MAN stands for Metropolitan Area Network. It covers an entire metropolitan area such as large city. It connects two or more LANs. A metropolitan area network is designed to share resources of different LANs in a city.

26. Define Wide Area Network (WAN).

Ans. Wide Area Network (WAN): WAN stands for Wide Area Network. It covers a large geographical area such as a country or around the world. WAN is normally used to connect multiple LANs and MANs at different locations. The Internet is the best example of wide area network.

27. What is network topology?

Ans. Network Topologies: The layout of computers and devices in a network is called network topology. In simple words we can say that the way computers and devices are connected in a network is called network topology. It is a geometric representation of the relationship among the interconnected devices.

28. Write down the types of Network Topologies.

Ans. Types of Network Topologies: Different types of network topologies are as follows:

- Bus topology
- Star topology
- Ring topology
- Mesh topology

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29. What is bus topology?

Ans. Bus topology: In bus topology a main transmission line is laid down in the center of the network and all the devices and computers are connected to it. This line/cable is called backbone of the topology. The physical line is called bus that is why this type of network is called bus network or bus topology. Data travel through the center line until it reaches the required devices or computer.

30. Write down some advantages of Bus Topology.

Ans. Advantages of Bus Topology: Some advantages of bus topology are as follows:

- It is simple and less expensive.
- It is easy to install bus network topology.
- It requires small length of cable to connect computers.

31. Write down some disadvantages of Bus Topology.

Ans. Disadvantages of Bus Topology: Some disadvantages of bus topology are as follows:

- It only supports small number of computers.
- The network speed slow down as the number of computers increases.
- It is difficult to troubleshoot.

32. Define star topology.

Ans. Star topology: In star topology all devices and computers are connected to a central device like a router, switch or a hub, etc. Data is sent for the central device which then sends out data to desired host. In this topology if one device fails then the rest of the network is unaffected. On the other hand if central device breaks down the whole network breaks down.

33. Write down any two advantages of star topology.

Ans. Advantages of Star Topology: Some advantages of star topology are as follows:

- It is very easy to maintain the network.
- Easy to troubleshoot.
- It is more flexible than other topologies.

34. Write down disadvantages of star topology

Ans. Disadvantages of Star Topology: Some disadvantages of star topology are as follows:

- It is more expensive.
- It requires more cable to connect to the server.
- If central hub fails, the entire network breaks down.

35. Define ring topology.

Ans. Ring topology: A ring topology connects a computer with exactly two other computers forming a ring of computers. A computer can send data to its immediate neighbor. A ring can be unidirectional or bidirectional. A failure of connection between two computers may down the whole network.

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36. What is unidirectional ring topology?

Ans. Unidirectional Ring Topology: In a unidirectional ring topology, data is sent either clock wise or anti clock wise.

37. What is bidirectional ring topology?

Ans. Bidirectional Ring Topology: In a bidirectional ring topology, data can travel in any direction.

38. Write down the advantages of ring topology.

Ans. Advantages of Ring Topology: Some advantages of ring topology are as follows:

- It is less expensive than bus topology.
- It requires less cable to connect the computers to the server.
- Every computer has equal access to the network.

39: Write down the disadvantages of ring topology.

Ans. Disadvantages of Ring Topology: Some disadvantages of ring topology are as follows:

- It is difficult to troubleshoot.
- Adding or removing computers affects the whole network.
- Failure of one computer in the ring can affect the whole network.

40. Define Mesh topology

Ans. Mesh Topology: In mesh topology each node is exactly connected to one or multiple other nodes on a network. In this topology all hosts can also be connected to each other which is known as full mesh. Mesh topology is an expensive topology in terms of cable cost as it uses a lengthy cable to connect computers as compared to the cable used in other topologies.

41. Write down some advantages of Mesh Topology

Ans. Advantages of Mesh Topology: Some advantages of mesh topology are as follows:

- It is easy to troubleshoot.
- If one node on a mesh network fails, the network can still function.

42. Write down some disadvantages of Mesh Topology

Ans. Disadvantages of Mesh Topology: Some disadvantages of ring topology are as follows:

- It is difficult to install and modify.
- A full mesh network can be very expensive.

43. Define data communication.

Ans. Data Communication: Data communications refers to exchange of messages between sending and receiving devices through some communication medium. These messages are actually the information which can be presented in many forms like text, numbers, images, audio and video.

44. Write down the Components of Data Communication

Ans. Components of Data Communication: Basic components of data communications system are as follows:

- Sender
- Receiver
- Message
- Protocol
- Transmission Medium

45. Define sender.

Ans. Sender: The device on a network that is used to send the data or signal to other connected device is called sender device. It is also called source/ Sender or transmitter. Sender is a device that initiates the communication process. It sends messages consisting of text, numbers, pictures etc. Normally, computer is used as a sender in a communication system.

46. Define receiver.

Ans. Receiver: Receiver is a device that receives a message. It is also called sink. The receiver can be a computer, printer or another device. The receiver must be capable of accepting a message. Cellular Phone and Computer both can be sender as well as receiver.

47. Define message.

Ans. Message: A message is the data or information that the sender wants to communicate to the receiver. The message might be a document having text, numbers, a picture, sounds, video or any combination of these.

48. Write down the parts of the message.

Ans. In a data communication system, a message is sent in the form of packets. Each message has two parts:

- Payload
- Control information

49. What is the difference between payload and control information?

Ans. Payload and Control information: Payload is the actual contents of a message where as the control information contains information about the sender and the receiver. Control information is also called header of a message. It is just like writing a letter where we write a letter along with the information about its sender and receiver. In this example, your letter is the payload. It requires the control information in order to dispatch and get a reply.

50. What is meant by Protocols?

Ans. Protocols: A network protocol is a formal arrangement between two computers to send and receive information. Very specifically, a network protocol defines a set of rules and procedures for communication between a sender and a receiver. E.g. TCP/IP, HTTP and etc.

51. Define transmission medium.

Ans. Transmission Medium: Transmission medium is the physical path that is used to connect a sender and a receiver. The message travels through a transmission

medium. A transmission medium might include telephone wiring, fiber optic cable, microwave or satellites. Transmission medium is also called a communication channel.

52. What is data transmission mode?

Ans. Data Transmission Modes: The way data is transmitted from one place to another on a network is called data transmission mode. It is also called the data communication mode. It shows information flow direction. Sometimes, data transmission modes are also called directional modes.

53. Write down the types of Transmission Modes.

Ans. Types of Transmission Modes: There are basically three types of data transmission modes which are as follows:

- Simplex mode
- Half-duplex mode
- Full-duplex mode

54. Define Simplex Mode.

Ans. Simplex Mode: In simplex mode, data can flow in one direction only. In this mode, a sender can only send data and cannot receive it. Similarly, a receiver can only receive data but cannot send it. E.g. Radio transmission.

55. Define Half-Duplex Mode

Ans. Half-Duplex Mode: In half-duplex mode, data can flow in both directions but only in one direction at a time. In this mode, data is sent and received alternatively. The Internet browsing is an example of half duplex mode.

56. Define Full-Duplex Mode

Ans. Full-Duplex Mode: In full duplex mode, data can flow in both directions at the same time. It is the fastest directional mode of data communication. The telephone communication system is an example of full-duplex communication mode. Two persons can talk at the same time.

57. What is TCP/IP?

Ans. TCP/IP: The whole communication process is carried out in different layers, where each layer performs one or more specific tasks. The internet also uses a layered communication model, called the Transmission Control Protocol/Internet Protocol (TCP/IP) model. The TCP/IP is a suit of protocols that provides end to end connectivity between devices.

58. Write down the Layers of TCP/IP

Ans. Layers of TCP/IP: Transmission Control Protocol/Internet Protocol (TCP/IP) consists of five layers.

- Application layer
- Transport layer
- Network layer
- Data link layer
- Physical layer

59. What is the function of application layer?

Ans. Application Layer: While chatting you are concerned only about the messages without bothering about the kind of network, i.e. wireless or wired. This is called

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application layer where you type a message and send on the network. The address of the receiving device is provided in the form of header before message content.

60. Define transport layer.

Ans. Transport Layer: Transport layer establishes connection between a client and a server. It tries to send message but if there is some error like your computer is disconnected from the network then it informs the application program. If the network is fine, the application trust the transport layer that the message will reach at its destination.

61. Write down the function of network layer.

Ans. Network Layer: A program running on the network layer moves the data to the other network. So, a chat message is transferred to other Wi-Fi router of your friend from where it is delivered to your friend and he/she can see it on screen.

62. What is the function of data link layer?

Ans. Data Link Layer: Data link layer sends a message to the server connected with sender. If you are chatting at home with a Wi-Fi connection, then the data link layer sends message from your computer to the Wi-Fi router.

63. Define physical layer.

Ans. Physical Layer: Physical layer is about the physical medium used in communication, like cabling etc.

64. Define encapsulation.

Ans. Encapsulation: Each layer adds some control information called header with the data received from the layer above it. The actual content of message called payload, is hidden inside the header at each layer, like a letter is hidden inside an envelope. This is called encapsulation.

65. Write down the names of protocols in TCP/IP suit.

Ans. Protocols in TCP/IP suit: Some of the most widely used application layer protocols are as follows:

- FTP
- HTTP
- SMTP

66. Define FTP.

Ans. FTP: FTP stands for File Transfer Protocol. FTP is the standard TCP/IP protocol which is used for the purpose of transferring files from one computer to another. For example, if we want to transfer a document file to a remote computer, then we can use FTP protocol.

67. Define HTTP.

Ans. HTTP: HTTP stands for Hypertext Transfer Protocol. HTTP is a protocol used by World Wide Web (WWW) to transfer webpages between a client and a web server. A web server also called an HTTP server. We use this protocol while browsing internet. For secure data transfer, we use HTTPS.

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68. Define SMTP.

Ans SMTP: SMTP stands for Simple Transfer Protocol. SMTP is a standard protocol to transmit emails.

69. What is the use of web browsers?

Ans. Use of Web Browsers: Web browsers are used to access the World Wide Web (WWW) in an easy manner. Web browsers and web servers function together as a client server system. Client-server is a standard method for designing applications where data is kept in central locations (server computers) and efficiently shared with any number of other computers (the client) on request.

70. What is meant by IP addressing?

Ans. IP Addressing: IP address stands for Internet Protocol address. It is a unique identifier that is associated with a device when it is connected to a network. An IP address is assigned by a Dynamic Host Configuration Protocol (DHCP) server.

71. Write down the Standards of IP Addressing

Ans. Standards of IP Addressing: There are two standards of IP addressing:

- IPv4 addressing
- IPv6 addressing

72. Write the examples of IPv4 and IPv6 addressing.

Ans. Examples of IPv4 and IPv6 addressing

- IPv4 address is like: 172.16.54.1
- IPv6 address is like: 2001:db8:0:1234:0:567:8:1

73. How many bits are required to store the whole IP address in IPv4 standard?

Ans. Total 32 bits are required to store the whole IP address in IPv4 standard.

74. Who developed IPv6 addressing?

Ans. IPv6 was developed by the Internet Engineering Task Force (IETF). IPv6 became a Draft Standard in December 1998, and became an Internet Standard on 14 July 2017.

75. What is router?

Ans. Router: A router is a networking device that forwards data packets from one network to another. As the internet is called network of networks, so a router also directs the traffic on the internet.

76. How the router works?

Ans. A router analyses the destination IP address of an incoming data packet, determines the best route to forward the packet, and then sends it accordingly. A router is usually placed at the meeting point of two or more networks.

77. Define Routing Process

Ans. Routing Process: Routing is a process of taking data from one device and sending it to another device on a different network. Every data packet has two addresses, destination address and source address. Destination address is used to deliver the data packet at destination. Source address is used to identify the sender device.☆☆

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Data and Privacy

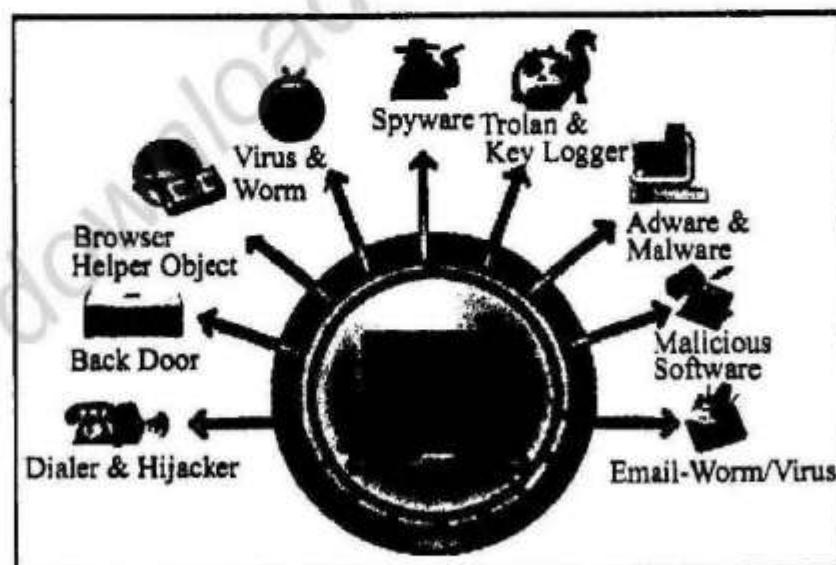
Q.1: What is meant by data privacy?

Ans. Data Privacy

Computers are ubiquitous and are widely used by people of almost all ages. Often we need to give our personal information to a computer e.g. while creating an email account, shopping online, visiting a hospital or taking admission in a school. We except that provided information will not be shared with others. Protecting data from malicious users is called data privacy or information privacy.

Q.2: What is meant by computer security? Write down its importance.

Ans. Computer Security

Computer security is set of measures and techniques that ensure confidentiality, integrity and availability of computers, their programs, hardware devices, and data. It is the process of preventing and detecting an unauthorized use of a computer and its resources.

Importance of Computer Security

With the increase of computer usage, the computer security risk has also increased. As we all know that computers are facing different kinds of security threats such as viruses, worms, adware, spyware, malware, hackers and crackers, etc.These threats can cause various types of damages to computer hardware, software, data, information or processing capabilities. So it is very important to secure data and information from being

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theft, delete, corrupt or steal. A computer security system ensures that we can work in a risk-free environment.

Q.3: What is meant by computer ethics? Write down some moral guidelines for ethical use of computers.

Ans. Computer Ethics

The moral guidelines and principles to regulate the use of a computer or an information system are known as computer ethics. It is very important to follow some rules and principles while using computers so that harmony of the society remains intact.

Computer Ethics

Moral Guidelines to the Ethical use of Computers

Some of the important computer ethics are given below:

- A computer should not be used to harm other people.
- It is totally unethical to access and destroy the files of the other peoples.
- Developing and intentionally spreading computer viruses is unethical.
- Reading other people's e-mail messages is completely unacceptable. This is invading their privacy.
- To transfer money by accessing the account of a company illegally using a computer is a criminal activity and considered as a robbery.
- Putting out false "information" to the world is bad using the Internet or other sources.
- Software is an intellectual product. Getting illegal copies of copyrighted software is ethically wrong.
- Hacking a system to break and bypass the authorization is unethical.
- Copying somebody else's program without proper authorization is software piracy and is unethical.
- Always develop such programs and animations that are not harmful for the society and decency should prevail in the development of programs.
- Show responsibility and be sensible in the use of computer hardware, software, and data.

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Q.4: Write down the ethical issues related to security.

Ans. Ethical Issues Related to Security

The foundation of all security systems is formed on ethical principles. If, we have data of others, it is our own ethical responsibility to keep it secure. Some of the data security issues are as follows:

- Confidentiality and Privacy
- Fraud and misuse
- Patent
- Copyright
- Trade secrets
- Sabotage

Q.5: Explain the Confidentiality and Privacy of data.

Ans. Confidentiality and Privacy of Data:

To keep the data of others as confidential is indeed taking care of others. For example, if a bank shares the information about my banking transactions with my business competitors then it can harm my business. Similarly, phone companies are supposed to keep the invoices and bills as confidential. Keeping privacy and confidentiality has become difficult in this era of computers and internet.

Due to more usage of computers, a wide range of data is collected and stored. This data may be related to credit cards, organizational fund raising campaigns, opinion polls, shop at home services, driving licenses, arrest records and medical records. The potential threats to privacy include the improper use of computerized data. If a company sells email IDs and phone numbers to another company for marketing purpose, it breaches the confidentiality of data.

Q.6: What is meant by software piracy? Explain.

Ans. Software Piracy

Piracy means making illegal copies. It can be book, software, movie, poetry, painting, house architecture or any other work protected by copyright law. Software piracy is the illegal copying, distribution or usage of software.

Some software companies sell software with a confidential text, called the key of that software. This key is provided to only those people who buy that software. In this

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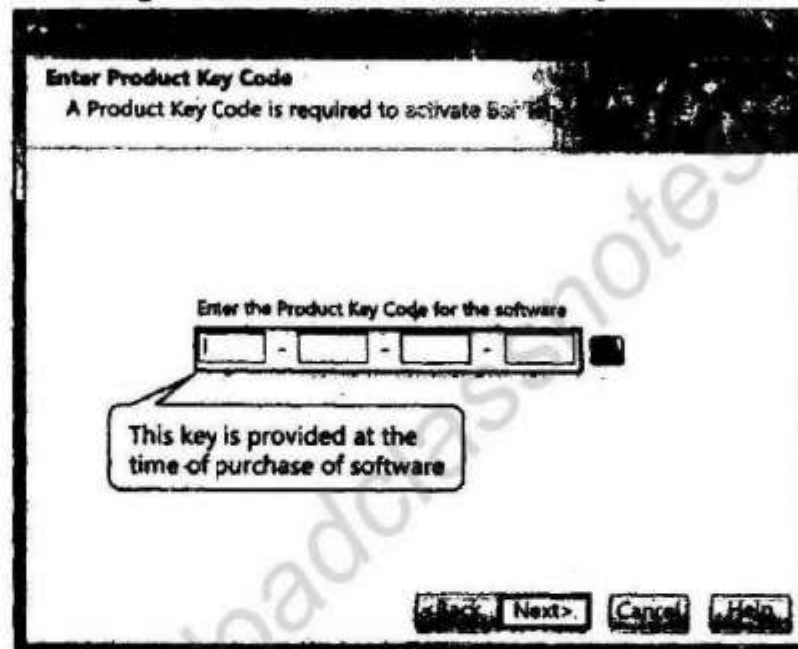
way illegal copies are stopped to be installed as shown in the figure below. Some people start searching for that key by using illegal means. This is called cracking the key. Open source software has no copyrights reservation. So, we can copy source code, modify it and can even sell it. Whether we do the piracy intentionally or unintentionally, it is illegal and punishable. Pirated software takes away the profits of the company or individual which results in reducing funds for further software development initiatives.

Activating the software

Types of Software Piracy

Types of software piracy include:

- Soft lifting
- Client-server overuse
- Hard-disk loading
- Counterfeiting
- Online piracy

a) Soft lifting

Borrowing and installing a copy of a software application from a colleague is called soft lifting.

b) Client server overuse

Installing more copies of the software than you have licenses for is called client server overuse.

c) Hard disk loading

Installing and selling unauthorized copies of software on refurbished or new computers is called hard disk loading.

d) Counterfeiting

Duplicating and selling software having copyright is called counterfeiting.

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e) Online piracy

Typically involves downloading illegal software is called online piracy.

The software industry is prepared to battle against software piracy. The courts are dealing with an increasing number of lawsuits concerning the protection of software.

Q.7: What is meant by fraud and misuse of computers?

Ans. Fraud and misuse

Using computers over the internet, some unauthorized activities can take place. Some of these include theft of money by electronic means, theft of services and theft of valuable data. Sometimes, we receive an email asking us to click on a link to change our password. When we click on the link, a webpage opens asking us to give our username and password. If we give our username and password, actually our password is stolen by some malicious user.

Likewise, some emails try to fool us by stating that we have won a grand prize e.g. a car or a house. They ask us to pay a small amount as transfer fee to get that prize. Actually, it is just a way to fool people and get money from them.

Sometimes, some malicious user disguises himself as our friend and tries to get some confidential information. This is called phishing.

Q.8: What is meant by patent? Explain it with the help of an example.

Ans. Patent

Patent is a way to protect an idea. If you are doing research in some field and you have an idea, then you must get patent for that idea. It gives you the right to exclude others from making or selling an invention using your idea.

Example

If you are doing research in medical field and give a new idea to treat a particular disease, some pharmaceutical companies can make medicines on the basis of your idea. Ethically, they must seek your permission before making medicines using your idea. For this purpose, you must get a patent.

Q.9: Explain copyright law.

Ans. Copyright Law

Copyright is different from a patent as copyright law says that some idea or product cannot be copied. The rights are reserved for copying. Usually, if a product is copyright protected then we see a symbol of copyright as shown in the following figure.

Copyright symbol

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For example, the book you are reading is copyright protected. So, making its photocopy is illegal.

Similarly, software products are mostly copyright protected. It means that we cannot copy them, like MS windows, MS Office etc. Copyright can deal with misappropriation of data, computer programs, documentation or similar material.

Q.10: What is meant by trade secrets?

Ans. Trade secrets

Trade secrets are usually the secrets that are playing an important role for the success of a company. They have a lot of value and usefulness for the company. Keeping trade secrets in the computer science field is very important when more than one software companies develop the same product but one of them takes lead. For example, there are many free email services but few of them have significant competitive advantage over others.

Q.11: What meant by sabotage?

Ans. Sabotage

Sabotage is a serious attack on a computer system. Some malicious user can attack the system while sitting remotely. One can send virus with some free software. A virus is a computer written program with negative intentions. It can change/ destroy information or sabotage a precious data. These software's are designed to harm a computer without the permission of a user. Virus can delete, modify and damage files. It can also effect programs and slow down the performance of the computer system.

Examples

Some examples of computer virus are as follows:

- Klez
- Friday 13th
- Blaster
- Cascade
- Boot sector virus
- Macro virus
- File virus
- Shortcut virus

Problems caused by Virus

Virus can cause many problems. It may:

- Erase data stored on the disk.
- Damage the files stored on the computer.
- Display unusual messages.
- Affect the normal working of the computer.

Signs of the computer virus

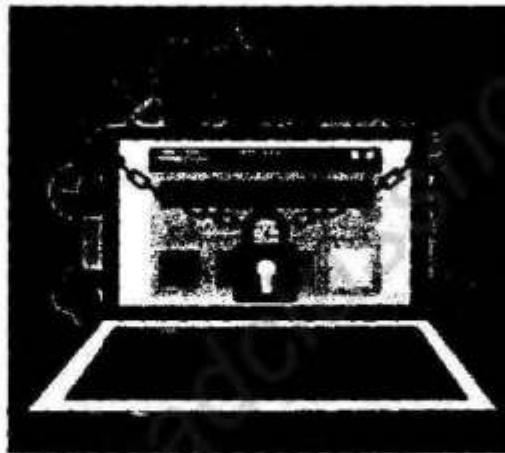
Some signs and symptoms the computer have a virus are as follows:

- Computer is really slow
- Random Programs Opening Up
- Programs Freezing or Crashing

- Pop-ups
- Browser Redirects

Q.12: What is meant by safeguarding privacy of others? Write down the measures to ensure the privacy of information

Ans. Safeguarding privacy of others

The right of an individual or an organization to refuse or restrict someone to access information about them is called information privacy. It is very unethical to monitor some ones e-mail messages and computer usage. There are some employers who monitor the computer usage of their staff.

Did you notice, speed cameras are announced before taking your picture or recording your video. These steps are just to safeguard your privacy. In the same way, when you give information to an organization, it is the duty of that organization to safeguard your privacy. Your information is stored in NADRA (National Database and Registration Authority) along with information of your other family members. So, safeguarding this data is an ethical responsibility of NADRA.

Most of the websites also declare their privacy policies, indicating what information they collect from you and your computer, and with whom they will share it. People usually do not read these policies. Most users mistakenly assume that their privacy is fully protected due to the privacy policy. Actually, the website wants to inform you that how far they will go to safeguard your privacy.

Measures to ensure the privacy of information

We can take different measures to make our data more private. Some of the important measures are as follows:

- We have to be very careful while filling out online forms with personal information.
- Always give your personal information to the persons or organization that you trust.
- The organization collecting personal information must make sure it is used by the authorized users.

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Q.13: Explain the privacy concerns that arise through the mass collection of data.

Ans. Privacy Concerns that arise through the Mass Collection of Data

Many organizations are keeping our data due to the computerized systems in place. There can be more people/ organizations having information about you than you think. For example:

- A hospital may have your birth record.
- NADRA has your family information.
- Your school has your record.
- BISE (Board of Intermediate and Secondary Education).
- Passport office if you have a passport.
- Email service providers if you have email accounts.
- Online social networking websites etc.

There are companies interested in a lot more than just your name, address and other basic facts about your life. They want to know where you have travelled, what type of cloths you wear, how often you have been sick, if you buy a product then do you buy something else with that product or not and much more. Answers of these questions help them in decision making.

Example

If you buy a packet of potato crisps, then you usually buy a drink as well. This information is useful for a shopping mall to increase it sales if it introduces new offers on both potato crisps and drinks. So, a piece of information can flow from one place to another without any intimation. It is due to mass collection of data.

Q.14: How would you analyze the personal privacy and security concerns that arise with any use of computational systems.

Ans. Analysing the personal privacy and security concerns that arise with any use of computational systems

With the advent of internet, our computers are no longer stand alone devices. In fact, now they are connected to millions of other computers in the world. Due to this connectivity, many security concerns also arise. Primarily, we want to secure our data according to the following four aspects:

Aspects of Data Security

Basically there are four main aspects of data security:

- **Confidentiality**

Data confidentiality assures that private or confidential information is not made available or disclosed to unauthorized individuals.

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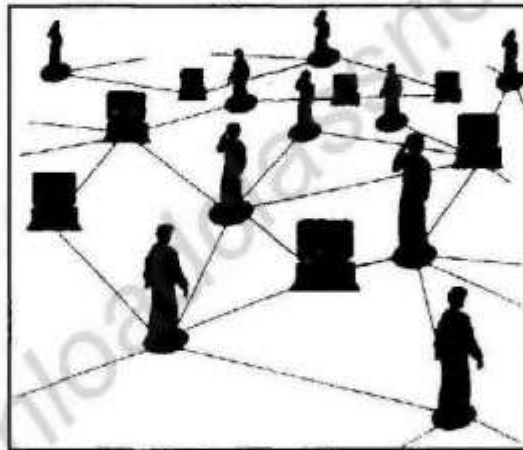
- **Privacy**

Privacy assures that individuals control or influence what information related to them may be collected and stored and by whom and to whom that information may be disclosed.

- **Integrity**

➢ It means that we want to keep the data correct. For example, we do not want that the website of our bank shows less account balance than it actually is.

➢ Data integrity assures that information and programs are changed only in a specified and authorized manner.

➢ System integrity assures that a system performs its intended function in an unimpaired manner, free from deliberate or inadvertent unauthorized manipulation of the system.

- **Availability**

➢ It means that we want to have access to the data when we want. If data is not available when needed, then in some cases it becomes useless.

➢ Assures that systems work promptly and service is not denied to authorized users

➢ It makes sure that the hardware is not damaged or stolen.

➢ It makes sure that the system works without any problem.

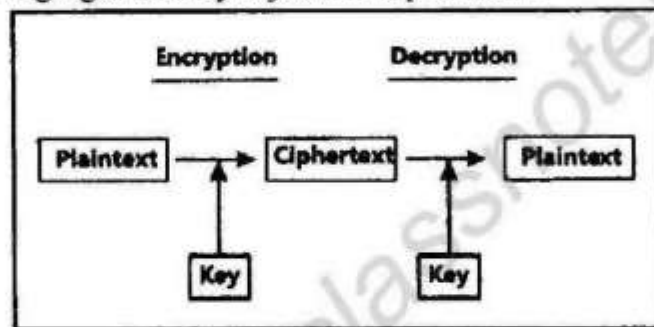
All these aspects are important during the processing, storage and transmission of data in a computerized system. Computation is a general term for any type of information processing that can be represented mathematically. For example, your grade in 9th class will be computed according to your marks in every subject.

In everyone's life there is a stunning growth of usage of computational systems. This fact is behind raising concerns about privacy. When we surf the internet, personal information is generated that may be of interest to businesses or people with malevolent aims. Companies want to read minds of web surfers and sometimes they store some piece of information with the web surfer, called cookies.

Using "cookies", companies are able to track purchases and gather personal data. They can use this information to target their marketing. It can be considered an invasion of their privacy.

Q.15: What is simple encryption? Explain.

Ans. Simple Encryption

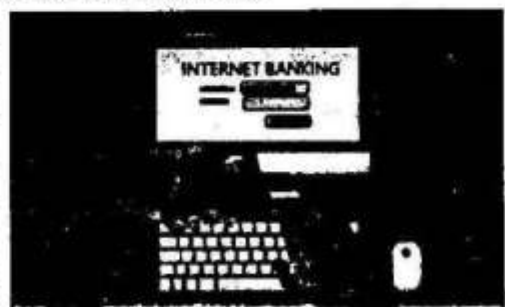
The process of encoding data in such a way that only authorised person can read it is called encryption. Encoding means conversion of the data to an unreadable format which is called ciphertext. A secret code (called key) is required to read the data as shown in the following figure. A key is just like a password.

Encryption -Decryption Process

In ancient times messages were carried by foot for miles, kings and rulers used to encrypt the letters they would send to allies. This helped to protect the secrecy of the message in case they were stolen.

A computer expert, who can steal data when it moves from one location to other, is called hacker. Encryption helps us to save data from hackers.

Q.16: Write the importance of encryption for everyday life on the internet.

Ans. Importance of encryption for everyday life on the internet:

Encryption is one of the most important methods for providing data security. In everyday life on the internet, vast amounts of personal information are stored on multiple places. So, it is important to know how to keep data private. Encryption is important because it allows you to secure data from illegal access. Importance of encryption can be described in the following three points.

1. Protection from Hackers:

Hackers don't just steal information; they can also alter the data to commit fraud. For example, in a bank transaction of online money transfer, they can fraud by changing the target account number.

2. Encryption Protects Privacy:

Encryption is used to protect sensitive data, including personal information for individuals. This helps to ensure privacy and minimising the opportunities for surveillance by criminals.

3. Encryption Protects Data across Devices:

Multiple (and mobile) devices are a big part of our lives, and transferring data from device to device is a risky proposition. Encryption technology can help protect stored data across all devices, even during transfer. Additional security measures like advanced authentication help dater unauthorized users.

Q.17: Define substitution cipher method? Explain its types.

Ans. Substitution Cipher Method

Substitution cipher methods are the methods of encryption in which the characters of original text are replaced by some other characters. This substitution is done by a fixed predefined system.

Types of Substitution Cipher Methods

There are two commonly used cipher methods:

- Caesar Cipher
- Vigenere Cipher

a) Caesar Cipher

Caesar was a Roman politician and military general who played a critical role in the rise of the Roman Empire. Caesar used this method of encryption for sending messages to his soldiers and generals. This is the reason for calling this method as Caesar Cipher. In this method, we replace each alphabet in the plaintext by another alphabet. The replacing alphabet is some fixed number of steps to the left or right of original alphabet in the sequence of alphabets.

Example 1:

A three character substitution to the right results in the following transformation of the standard English alphabet.

Initial alphabets: ABCDEFGHIJKLMNOPQRSTUVWXYZ

Encryption alphabets: DEFGHIJKLMNOPQRSTUVWXYZABC

Within this substitution scheme, the plaintext PAKISTAN would be encrypted into the ciphertext SDNLVWDQ.

Example 2:

A five character substitution to the right results in the following transformation of the standard English alphabet:

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Initial alphabets: ABCDEFGHIJKLMNOPQRSTUVWXYZ

Encryption alphabets: FGHIJKLMNOPQRSTUVWXYZABCDE

Within this substitution scheme, plaintext PAKISTAN would be encrypted into the ciphertext UFPNXYFS.

b) Vigenere Cipher

Vigenere cipher is another substitution cipher, which uses a table known as Vigenere Cipher table for substituting the letters of plaintext.

Vigenere Cipher Table

The Vigenere Cipher Table consists of 26 rows and 26 columns, where the 1st row contains the original alphabets from A – Z. In each subsequent row the alphabet is shifted by one letter to the right. All the columns are labeled by alphabets from A – Z and all the rows are also labeled by alphabets from A – Z. Vigenere cipher table is shown below:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
A	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	[illegible]	Q	R	S	T	U	V	W	X	Y	Z
B	[illegible]	C	D	E	F	G	H	I	J	K	[illegible]	M	N	O	P	[illegible]	R	S	T	U	V	W	X	Y	Z	A
C	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	[illegible]	S	T	U	V	W	X	Y	Z	A	B
D	D	E	F	G	H	I	J	K	L	M	[illegible]	O	P	Q	R	[illegible]	T	U	V	W	X	Y	Z	A	B	C
E	[illegible]	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	[illegible]	U	V	W	X	Y	Z	A	B	C	D
F	[illegible]	G	H	I	J	K	L	M	N	O	[illegible]	Q	R	S	T	[illegible]	V	W	X	Y	Z	A	B	C	D	E
G	G	H	I	J	K	L	M	N	O	P	[illegible]	R	S	T	U	[illegible]	W	X	Y	Z	A	B	C	D	E	F
H	[illegible]	I	J	K	L	M	N	O	P	Q	[illegible]	S	T	U	V	[illegible]	X	Y	Z	A	B	C	D	E	F	G
I	[illegible]	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	[illegible]	Y	Z	A	B	C	D	E	F	G	H
J	J	K	L	M	N	O	P	Q	R	S	[illegible]	U	V	W	X	[illegible]	Z	A	B	C	D	E	F	G	H	I
K	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	[illegible]	A	B	C	D	E	F	G	H	I	J
L	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	[illegible]	B	C	D	E	F	G	H	I	J	K
M	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	[illegible]	C	D	E	F	G	H	I	J	K	L
N	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	X	Y	Z	A	B	[illegible]	D	E	F	G	H	I	J	K	L	M
O	O	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	[illegible]	E	F	G	H	I	J	K	L	M	N
P	P	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	[illegible]	F	G	H	I	J	K	L	M	N	O
Q	Q	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	[illegible]	G	H	I	J	K	L	M	N	O	P
R	R	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	[illegible]	H	I	J	K	L	M	N	O	P	Q
S	S	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	[illegible]	I	J	K	L	M	N	O	P	Q	R
T	T	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	[illegible]	J	K	L	M	N	O	P	Q	R	S
U	U	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	[illegible]	K	L	M	N	O	P	Q	R	S	T
V	V	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	[illegible]	L	M	N	O	P	Q	R	S	T	U
W	W	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	[illegible]	M	N	O	P	Q	R	S	T	U	V
X	X	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	[illegible]	N	O	P	Q	R	S	T	U	V	W
Y	Y	Z	A	B	C	D	E	F	G	H	I	J	K	L	M	[illegible]	O	P	Q	R	S	T	U	V	W	X
Z	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	P	Q	R	S	T	U	V	W	X	Y

Vigenere Cipher Method

In this method we have a substitution key that is combined with the plaintext to generate the ciphertext. We encrypt each letter of the plaintext by finding that letter in column labels of the Vigenere Cipher table and in that column, we find a letter that is in front of the row label for the respective letter of the key. We continue this process until all the text is finished.

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Example

Let's assume that we want to encrypt "PAKISTAN" with the help of substitution key "ZINDABAD". We find 'P' (first letter of the plaintext) in column labels and 'Z' (first letter of substitution key) in row labels. We can observe that the row and the column meet at letter 'O' as marked with yellow colour in Vigenere Cipher Table. So, the letter 'P' is converted to 'O'. Similarly, we find the letter 'A' in column labels which is the first column (marked with green colour) in Vigenere Cipher Table and we find the letter 'I' in the row labels. Row and column meet at letter 'I'. So, 'A' is replaced with 'I'.

In this way the word 'PAKISTAN' is converted to cipher text "OIXLSUAQ" as show in the table below:

Column Label	P	A	K	I	S	T	A	N
Row Label	Z	I	N	D	A	B	A	D
Common letter	O	I	X	L	S	U	A	Q

Important Note: If the key has less number of letters, then we repeat the letters of that key from beginning. For example, to encrypt the text "PAKISTAN" having 8 letters with the key "BEAUTY" having 6 letters, we repeat the letters of the key to make them equal in length to the given plaintext. So, the key becomes "BEAUTYBE" having same number of letters and this key is called interim ciphertext.

Q.18: Explain Vigenere Cipher Encryption Widget.

Ans. Vigenere Cipher Encryption Widget

Vigenere Cipher Encryption Widget shows animation of the encryption and decryption of plaintext by using Vigenere Cipher method according to a given key. This widget is available at the website: https://studio.code.org/s/vigenere/stage/1/puzzle/1. Screenshot of this widget is shown in figure given below:

Vigenere Cipher Widget

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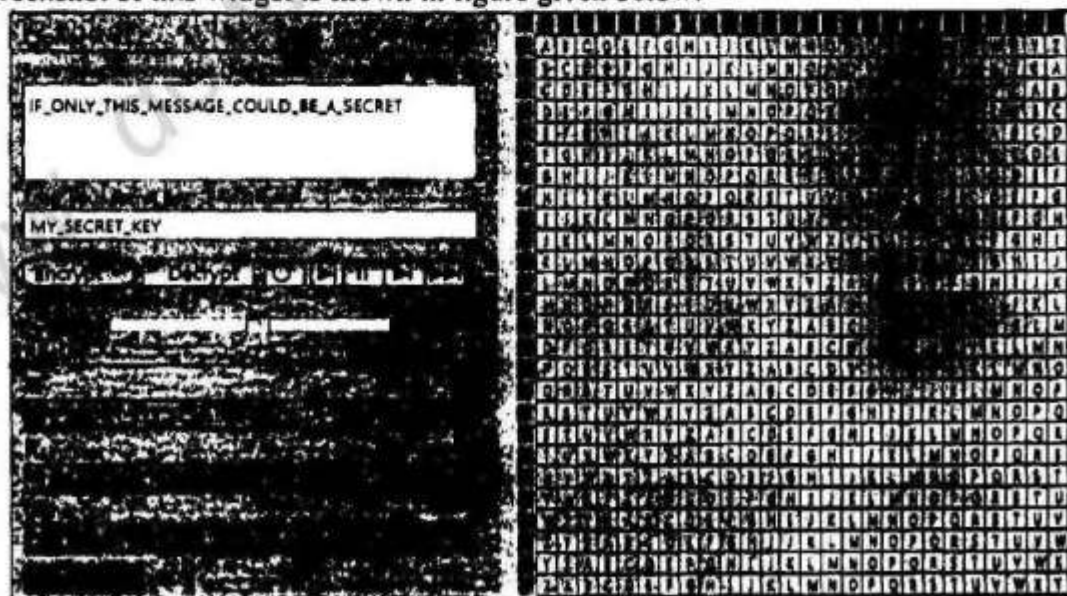
Website: www.downloadclassnotes.com Mobile App: bit.ly/DCNApp

You can type text on upper left corner and provide a key for encryption. Press the "Encrypt" button and then click on ▶to see the animation of encryption. Similarly, we can decrypt a ciphertext to see the original message.

Practical to Decrypt a Message

To decrypt a message, we find the letters of key in the rows of Vigenere table and then in that row we locate the letter of encrypted text. When the letter is found we take the column heading for that letter as decrypted letter. For example, to decrypt "OIXLSUAQ" with the key "ZINDABAD" we find the row for the letter 'Z' and in that rows we find the letter 'O' where we can identify the column heading i.e. 'P' in this case. Similarly, we continue with each letter of the cypher text and decrypt the cypher text.

Q.19: Explain encrypted with random substitution using frequency analysis.

Ans. Encrypted with Random Substitution using Frequency Analysis

Messages encrypted with the Caesar cipher are very easy to crack. What if instead of shifting the whole alphabet, we map every letter of the alphabet to a random different letter of the alphabet? This is called a random substitution cipher.

We can visit the website: https://studio.code.org/s/frequency_analysis/stage/1/puzzle/1 to view the widget for this purpose. It's screenshot is given below:

Random Substitution using Frequency Analysis Widget

In this version of the tool, you will be interacting more with the graphs that show letter frequency. May be the most common letter in your encrypted text maps to the letter 'E', but may be not. You will have to do a bit of guess and check to see if that substitution

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makes sense

In cryptanalysis, frequency analysis is the study of the frequency of letters or groups of letters in a ciphertext. The method is used as an aid to breaking classical ciphers.

Q.20: Write down the weaknesses and security flaws of substitution ciphers.

Ans. Weaknesses and Security Flaws of Substitution Ciphers

The main weaknesses and security flaws of substitution ciphers are as follows:

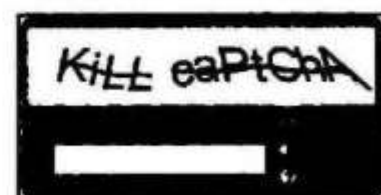
- The simplest of all substitution ciphers are those in which the cipher alphabet is merely a cyclical shift of the plaintext alphabet. The explanation for this weakness is that the frequency distributions of symbols in the plaintext and in the ciphertext are identical, only the symbols having been relabelled.
- Another major problem with simple substitution ciphers is that the frequencies of letters are not masked at all.

Q.21: What is the relationship between cryptographic keys and passwords?

Ans. Relationship between Cryptographic keys and Passwords

Passwords are used for authentication to enter a system whereas cryptographic keys are used to read an encrypted message. So, with respect to computer security a "key" is not synonymous with "password". It is also possible that a password can be used as a key. The basic difference between these two is that a password is generated, read, remembered and reproduced for a human use while a key is used by the software or human to process a message by using that key and the cryptographic algorithm.

Some server computers store key on our computers when we access them first time. For later use, the same key is used on our behalf but without any action from our side.

We can write a program that can access a website and give it a password. It can be used to hack a password if the program keeps trying different password for long time. Moreover, a program can also add unnecessary data by filling a form again and again. To avoid this situation only humans are allowed to use a system instead of a computer program. So, a picture is shown on a website whenever there is a form and you are asked to read that image and fill a field. The image contains text in irregular form which is readable for human but not easily for a machine.

Q.22: Write down the characteristics of a good password.

Ans. Characteristics of a Good Password

A good password should be difficult to guess or crack. It helps to prevent

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unauthorized people from accessing files, programs and other resources. A good password has the following characteristics:

- A password is at least eight characters long.
- It does not contain user name, real name, kids name or company name.
- It does not contain a complete word.
- A good password is significantly different from previous passwords.
- A good password contains uppercase letters, lowercase letters, numbers and symbols.

Q.23: What is meant by cybercrime? Explain.

Ans. Cybercrime

Any criminal activity which is performed by using computers and the Internet is known as cybercrime. A cybercrime can be downloading illegal music files or stealing millions of dollars from online bank accounts. It also includes crime like identity theft, threatening someone using Internet, etc.

Forms of Cybercrimes

Some forms of cybercrimes are as follows:

- Identity theft
- Transaction fraud
- Advance fee fraud
- Hacking
- Piracy

a) Identity Theft

One common form of cybercrime is identity theft. Hackers may use fake emails to trap someone to give passwords and account information.

b) Transaction Fraud

Simple financial fraud is another common crime in the online arena. A scammer may offer an item for sale through an auction site with no intention of delivering once he/she receives payment. Alternatively, a criminal might purchase an item for sale using a stolen credit card. It is also possible to buy something from own credit card but then reporting the card stolen. This is a transactional fraud if the card holder claims charge back.

c) Advance Fee Fraud

Sometimes the hackers congratulate you upon winning a big prize and ask you pay

a small amount in advance, so that the prize can be dispatched. This is a common type of cybercrime. The lure of easy wealth has found many victims of these frauds.

d) Hacking

Another cybercrime is the practice of hacking, illegally accessing someone else's computer. This happens mostly when you download some file from internet and execute it without knowing details. A skilled computer user who does the hacking is called a hacker. Hackers may create problems for banks, hospitals, business organizations and government departments.

Effects of Computer Hacking

- An unexplained decrease in hard drive space availability
- Files unexpectedly appear or grow in size
- Files unexpectedly disappear or are modified
- Sudden computer or network performance changes
- Frequent crashes
- Strange messages or dialog boxes appearing on our screen
- Our computer or router Internet data transfer light blinking, when we're not accessing the Net

A software installed in your computer connects someone else to your computer without your permission. The aim is to gather information about a person or organization sometimes without their knowledge. This type software is called spyware. It is the most common software which is installed on system without knowledge of the user.

Some spyware also tracks the keystrokes of the user's keyboard. When users type their e-mails, passwords, credit card number, and etc. spyware stores keystrokes and send it to the person who designed it. Who can later use this information for his/her malicious intent?

Examples

Some examples of spyware are as follows:

- CoolWebSearch
- Internet Optimizer
- Zango
- HuntBar
- Zlob Trojan

e) Piracy

Piracy is also a type cybercrime. Piracy means making illegal copies. It can be book, software, movie, poetry, painting, house architecture or any other work protected by copyright law. Software piracy is the illegal copying, distribution or usage of software.

Q.24: Define phishing. Write down the characteristics of phishing emails.

Ans. Phishing

Phishing is the fraudulent attempt by sending emails to obtain sensitive information such as usernames, password and credit card details.

Characteristics of Phishing Emails

The characteristics of phishing emails are as follows:

1. It normally appears as an important notice, urgent update or alert. The subject of such email is set in a way that the email recipient believes that the email has come from a trusted source.

Examples:

a) Someone tried to open your account. Change your password immediately.
b) Official data breach notification.
c) Packet delivery at your home address.
d) IT Reminder: Your password Expires in less than 24 hours.
e) Change of password required immediately.
f) Revised vacation & Sick time policy.
g) Email account updates.

2. It sometimes contains messages that sound attractive rather than threatening e.g. promising the recipients a prize or a reward.
3. It normally uses forged sender's address. For example, admin@facebook.com, info@gmail.com etc. you can also open an email if it is from principal@yourschool.edu.pk. In email there can be some link that has no relation with your school. So, while filling online forms, take care of the URL (Uniform Resource Locator) appearing in the address bar of the web browser.
4. It usually takes contents such as logos, images from the actual website to make the fraudulent email look like a genuine email.
5. It may contain a form for the recipient to fill in personal/ financial information and let recipient submit it. This information is submitted to a different database.

Q.25: Write down the characteristics of a phishing website.

Ans. Characteristics of a Phishing Website

Characteristics of a phishing website are as follows:

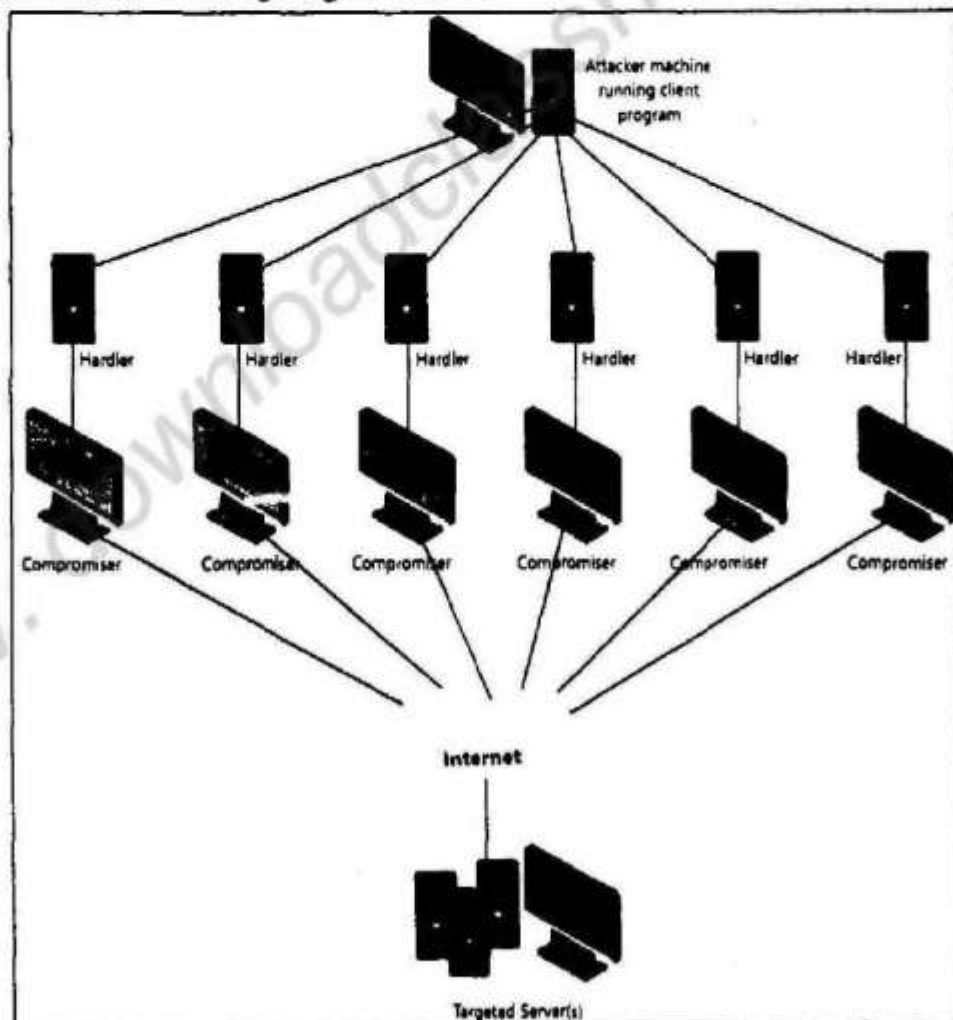
- It looks like original due to same contents such as images, texts, logos, colour

schemes etc.

- It may contain actual links to web contents of the legitimate website such as contact us, privacy or disclaimer to trick the visitors.
- It may use similar name as that of the actual website.
- It may use forms to collect visitor's information where these forms are similar to those in the legitimate website.

Q.26: What is meant by DoS (Denial of Service) attack? Explain.

Ans. DoS (Denial of Service) Attack

In computing, a denial of service (DoS) attack is a cyber attack to make a machine or network resource unavailable. It means a service is denied. For example, if you want to visit a website but someone else is already sending too many requests to the same website using computer programs, then you may not be able to access that website. This type of attack is shown in figure given below:

A conceptual diagram of DoS attack

It is just like a robot is sending many requests in small amount of time, but for a user, either the service becomes very slow or it is denied. So, by flooding the targeted machine or resource with superfluous requests is an attempt to overload the system. It may also cause shutting down a machine or network.

DoS attackers often target web servers of high profile organizations such as banking, commerce and media companies or government and trade organizations. Though DoS attacks do not typically result in the theft or loss of significant information or other assets, they can cost the victim a great deal of time and money.

SUMMARY

- We need to be careful by sending data over the internet.
- Every organization to whom the data is entrusted. It is their responsibility regarding confidentiality and privacy of the data.
- Piracy means making illegal and unauthorized copies of the software without owner's permission.
- Softlifting is called borrowing and installing a copy of software application from a colleague.
- Client-server overuse is installing more copies of the software than you have licenses for.
- Hard disk loading means installing and selling unauthorized copies of software on refurbished or new computers.
- Counterfeiting is called duplicating and selling copyrighted programs.
- Using computer for the purpose of some unauthorized activities is called fraud or misuse.
- Promises made by a software developer is known as warranty or liability.
- Patent can protect an idea so that it won't be misuse and the owner will attain its full rights.
- To protect value and usefulness we may imply trade secrets.
- The computer can be attacked while sitting remotely, in this way sensitive information will be sabotaged.
- Encoding means conversion of the data to an unreadable format which is called ciphertext. Key is needed to read it.
- Passwords are used for authentication to enter a system.
- A crime in which computer network or devices are used is called a cybercrime.
- Illegally accessing someone else's computer is called hacking.
- Denial of service DoS attack is a cyber attack to make a machine or network resource unavailable for a user.

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SOLVED EXERCISE

4.1: Choose the correct option.

1. **Which of the following doesn't include the types of software piracy?**
   (i) Softlifiting (ii) Liability
   (iii) Client server overuse (iii) Online piracy
2. **Which of the following is not a cybercrime?**
   (i) Hacking (ii) Phishing crime (iii) Identity Theft (iv) Decryption
3. **Which of the following is not the characteristics of phishing emails?**
   (i) Official data breach notification (ii) Email account update
   (iii) IT reminder (iv) Similar domain of actual website
4. **Which of the following is not characteristics of phishing website?**
   (i) Similar domain of actual website (ii) Using of forms to collect visitors
   (iii) Actual link to web content (iv) Email account updates
5. **Which of the following is not a characteristics of good password?**
   (i) Is eight characters long (ii) Doesn't contain username
   (iii) Contains uppercase letters (iv) Password is your name only

Answers:

1. Softlifiting 2. Decryption 3. IT reminder
4. Actual link to web content 5. Password is your name only

4.2: Fill in the blanks:

1. Making illegal copies of software is called______.
2. ______ is a general term for any type of information processing that can be represented mathematically.
3. ______ is the process of encoding data.
4. When a key has less number of character than the text to encrypt, then repeating letters of the key is called______.
5. ______ is a cyber attack to make machine or network resource unavailable for a user.

Answers:

1. Piracy 2. Computation 3. Encryption
4. Interim Cypher Text 5. Denial of Service

4.3: Answer the following questions.

1. **Define cypher text.**

Ans. Cypher Text: Encoding means conversion of the data to an unreadable format which is called ciphertext. When a key has less number of character than the text to encrypt, then repeating letters of the key is called Interim Cypher Text.

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2. Why do we need an installation key whereas a software can be protected with a password?

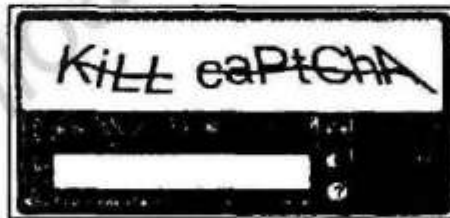
Ans. See question no.21

3. Define Denial of Service.

Ans. Denial of Service: Denial of service (DoS) attack is a cyber attack to make a machine or network resource unavailable for a user.

4. Give a reason to add captcha on websites.

Ans. Captcha: CAPTCHA stands for Completely Automated Public Turing Test to Tell Computers and Humans Apart. Its goal is to check if a user (of an app or a website) is a real person or a bot. To do that, it relies on specific traits that people have and machines don't. It's widely used in the web industry as a good protection against spam, bots or DoS attacks.

We can write a program that can access a website and give it a password. It can be used to hack a password if the program keeps trying different password for long time. Moreover, a program can also add unnecessary data by filling a form again and again. To avoid this situation only humans are allowed to use a system instead of a computer program. So, a picture is shown on a website whenever there is a form and you are asked to read that image and fill a field. The image contains text in irregular form which is readable for human but not easily for a machine. This is called captcha.

5. What is Patent, and why do we need to register it?

Ans. See question no.8

Objective Type Questions

- **Choose the correct answer:**

1. Which of the following is a general term for any type of information processing that can be represented mathematically?

(a) Coding (b) Computation (c) Encryption (d) Cypher Text

2. Which of the following is the process of encoding data?

(a) Cybercrime (b) Decryption (c) Computation (d) Encryption

3. When a key has less number of character than the text to encrypt, then repeating letters of the key is called:

(a) Cypher Text (b) Cyber space

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(c) Interim Cypher Text (d) Patent

4. **To protect value and usefulness we may imply:**
   (a) Sabotaged (b) Trade secrets (c) Cypher Text (d) Patent
5. **The computer can be attacked while sitting remotely. In this way sensitive information will be:**
   (a) Sabotaged (b) Trade secrets (c) Cypher Text (d) Patent
6. **Encoding means conversion of the data to an unreadable format which is called:**
   (a) Sabotaged (b) Trade secrets (c) Cypher Text (d) Patent
7. **Means making illegal and unauthorized copies of the software without owner's permission.:**
   (a) Piracy (b) Patent (c) Cypher Text (d) Encryption
8. **A criminal act that is performed by using computer and Internet is known as:**
   (a) Cyber space (b) Cyber crime (c) Crime (d) Computer crime
9. **A software which replicates itself automatically is called a(n):**
   (a) Virus (b) Adware (c) Worm (d) Spyware
10. **Which of the following is called borrowing and installing a copy of software application from a colleague?**
    (a) Hard disk loading (b) Client-server overuse
    (c) Counterfeiting (d) Softlifting
11. **Which of the following is installing more copies of the software than you have licenses for?**
    (a) Hard disk loading (b) Client-server overuse
    (c) Counterfeiting (d) Softlifting
12. **Which of the following means installing and selling unauthorized copies of software on refurbished or new computers ?**
    (a) Hard disk loading (b) Client-server overuse
    (c) Counterfeiting (d) Softlifting
13. **Which of the following is called duplicating and selling copyrighted programs?**
    (a) Hard disk loading (b) Client-server overuse
    (c) Counterfeiting (d) Softlifting
14. **Using computer for the purpose of some unauthorized activities is called:**
    (a) Fraud or Misuse(b) Hacking (c) Cracking (d) Softlifting
15. **Promises made by a software developer is known as:**
    (a) Warranty (b) Liability (c) Both (a) & (b) (d) None of above
16. **Can protect an idea so that it won't be misuse and the owner will attain its full rights.**
    (a) Piracy (b) Patent (c) Cypher Text (d) Encryption

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17. Which of the following is used for authentication to enter a system?
(a) Piracy (b) Patent (c) Password (d) Softlifting

18. A software that tracks the user's browsing habits is called a(n):
(a) Virus (b) Worm (c) Adware (d) Hacker

19. A programmer who breaks into a computer system is called:
(a) Cracker (b) Breaker (c) Hawker (d) Hacker

20. The program which infects a computer is called a(n):
(a) Antivirus (b) Virus (c) Hacker (d) Shareware

21. Which of the following cracks the licensed software and redistribute it illegally?
(a) Cracker (b) Breaker (c) Hawker (d) Hacker

22. Automatically displays or downloads advertisements on a computer:
(a) Spyware (b) Virus (c) Worm (d) Adware

23. Tracks the personal information of the user:
(a) Spyware (b) Virus (c) Worm (d) Adware

24. Software which protects a computer from spyware is called an:
(a) Spyware (b) Anti Spyware (c) Worm (d) Adware

25. The illegal copy of an original software is called:
(a) Application software (b) Entertainment software
(c) Pirated software (d) Pirates

26. The software which protects a computer from security threats is called:
(a) Antivirus (b) Spreadsheet software
(c) Graphic software (d) Application software

27. Illegally accessing someone else's computer is called:
(a) Piracy (b) Patent (c) Hacker (d) Hacking

28. The rights given to persons over the creation of their minds is called:
(a) Human rights (b) Property rights
(c) Intellectual rights (d) Intellectual property rights

29. It is right of an individual or organization to refuse someone to access information:
(a) Information piracy (b) Information accuracy
(c) Information privacy (d) Information property

30. It is a cyber attack to make machine or network resource unavailable for a user:
(a) Denial of service (DoS) attack (b) Virus
(c) Worm (d) Adware

Answers:

1. Computation 2. Encryption 3. Interim Cypher Text 4. Trade secrets

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5. Sabotaged **6.** Cypher Text **7.** Piracy **8.** Cyber crime
9. Worm **10.** Softlifting **11.** Client-server overuse
12. Hard disk loading **13.** Counterfeiting **14.** Fraud or Misuse
15. Both (a) & (b) **16.** Patent **17.** Password **18.** Adware
19. Hacker **20.** Virus **21.** Cracker **22.** Adware
23. Spyware **24.** Anti Spyware **25.** Pirated software **26.** Antivirus
27. Hacking **28.** Intellectual property rights
29. Information privacy **30.** Denial of service (DoS) attack

- **Give Short Answers:**

1. What is meant by data privacy?

Ans. Data Privacy: Protecting data from malicious users is called data privacy or information privacy.

2. What is meant by computer security?

Ans. Computer Security: Computer security is set of measures and techniques that ensure confidentiality, integrity and availability of computers, their programs, hardware devices, and data. It is the process of preventing and detecting an unauthorized use of a computer and its resources.

3. Write down the important computer security threats.

Ans. Computer Security Threats: Computers are facing different kinds of security threats such as viruses, worms, adware, spyware, malware, hackers and crackers, etc.

4. What is meant by computer ethics?

Ans. Computer Ethics: The moral guidelines and principles to regulate the use of a computer or an information system are known as computer ethics.

5. Write down any two data security issues.

Ans. Data Security Issues: Some of the data security issues are as follows:

- Confidentiality and Privacy
- Fraud and misuse
- Patent

6. What kind of data is collected and stored?

Ans. Due to more usage of computers, a wide range of data is collected and stored. This data may be related to credit cards, organizational fund raising campaigns, opinion polls, shop at home services, driving licenses, arrest records and medical records.

7. What is potential threat to the privacy of data?

Ans. The potential threats to privacy include the improper use of computerized data. If a company sells email IDs and phone numbers to another company for marketing purpose, it breaches the confidentiality of data.

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8. Define software piracy.

Ans. Software Piracy: Software piracy is the illegal copying, distribution or usage of software.

9. Define piracy.

Ans. Piracy: Piracy means making illegal copies. It can be book, software, movie, poetry, painting, house architecture or any other work protected by copyright law.

10. What is the use of the software key?

Ans. Some software companies sell software with a confidential text, called the key of that software. This key is provided to only those people who buy that software. In this way illegal copies are stopped to be installed.

11. What is meant by open source software?

Ans. Open Source Software: Open source software has no copyrights reservation. So, we can copy source code, modify it and can even sell it.

12. What is the disadvantage of pirated software?

Ans. Pirated software takes away the profits of the company or individual which results in reducing funds for further software development initiatives.

13. Write down the types of software piracy.

Ans. Types of Software Piracy: Types of software piracy include:

- Soft lifting
- Client server overuse
- Hard disk loading
- Counterfeiting
- Online piracy

14. Define Softlifting.

Ans. Softlifting: Borrowing and installing a copy of a software application from a colleague is called softlifting.

15. What is meant by client server overuse?

Ans. Client Server overuse: Installing more copies of the software than you have licenses for is called client server overuse.

16. What is meant by hard disk loading?

Ans. Hard disk loading: Installing and selling unauthorized copies of software on refurbished or new computers is called hard disk loading.

17. Define counterfeiting.

Ans. Counterfeiting: Duplicating and selling software having copyright is called counterfeiting.

18. Define online piracy.

Ans. Online Piracy: Downloading illegal software is called online piracy. It is a criminal act.

19. What is meant by patent?

Ans. Patent: Patent is a way to protect an idea. If you are doing research in some field and you have an idea, then you must get patent for that idea. It gives you the right to

exclude others from making or selling an invention using your idea.

20. What is copyright law?

Ans. Copyright Law: Copyright law says that some idea or product can not be copied. The rights are reserved for copying. Usually, if a product is copied protected then we see a symbol of copyright.

21. What meant by sabotage?

Ans. Sabotage: Sabotage is a serious attack on a computer system. Some malicious user can attack the system while sitting remotely. One can send virus with some free software.

22. Define computer virus.

Ans. Computer Virus: A virus is a computer written program with negative intentions. It can change/ destroy information or sabotage a precious data. It is designed to harm a computer without the permission of a user. E.g. Klez, Friday 13th, Cascade

23. Write down the problems caused by virus.

Ans. Problems caused by Virus: Virus can cause many problems. It may:

- Erase data stored on the disk.
- Damage the files stored on the computer.
- Display unusual messages.
- Affect the normal working of the computer.

24. Write down the signs of the computer virus.

Ans. Signs of the computer virus: Some signs and symptoms the computer have a virus are as follows:

- Computer is really slow
- Random Programs Opening Up
- Programs Freezing or Crashing
- Pop-ups
- Browser Redirects

25. What is information accuracy?

Ans. Information Accuracy: Information accuracy is one of the main ethics of computer usage. It is a person's or an organization's responsibility to provide accurate, and updated information on a topic. Today a lot of people rely on the information given on the internet or other information systems.

26. What is meant by information privacy?

Ans. Information Privacy: The right of an individual or an organization to refuse or restrict someone to access information about them is called information privacy. It is very unethical to monitor some ones e-mail messages and computer usage.

27. Write down the measures to ensure the privacy of information.

Ans. Measures to ensure the privacy of information:

We can take different measures to make our data more private. Some of the important measures are as follows:

- We have to be very careful while filling out online forms with personal information.
- Always give your personal information to the persons or organization that you trust.
- The organization collecting personal information must make sure it is used by the authorized users.

28. What are the aspects of data security?

Ans. Aspects of Data Security: Four aspects of data security are as follows:

- Confidentiality
- Privacy
- Integrity
- Availability

29. What is meant by data confidentiality?

Ans. Data Confidentiality: Data confidentiality assures that private or confidential information is not made available or disclosed to unauthorized individuals.

30. What is the use of data privacy?

Ans. Use of data privacy: Privacy assures that individuals control or influence what information related to them may be collected and stored and by whom and to whom that information may be disclosed.

31. Define data integrity.

Ans. Data Integrity: Data integrity is the overall accuracy, completeness, and consistency of data. Data integrity also refers to the safety of data in regards to regulatory compliance .Data integrity also ensures that your data is safe from any outside forces.

32. What is meant by system integrity?

Ans. System Integrity: System integrity assures that a system performs its intended function in an unimpaired manner, free from deliberate or inadvertent unauthorized manipulation of the system

33. What meant by the data availability?

Ans. Data Availability: It means that we want to have access to the data when we want. If data is not available when needed, then in some cases it becomes useless.

34. Define encryption.

Ans. Encryption: The process of encoding data in such a way that only authorized person can read it is called encryption. Encoding means conversion of the data to an unreadable format which is called ciphertext.

35. Define Interim Cypher Text

Ans. Interim Cypher Text: When a key has less number of character than the text to encrypt, then repeating letters of the key is called Interim Cypher Text.

36. Define hacker.

Ans. Hacker: A computer expert, who can steal data when it moves from one location to other, is called hacker. Encryption helps us to save data from hackers.

37. Define cracker.

Ans. Cracker: A programmer who breaks the security system of a network to access it illegally with criminal and destructive intent is known as cracker. They crack the licensed software without permission of author and redistribute the copies of the pirated software.

38. Define substitution cipher method.

Ans. Substitution Cipher Method: Substitution cipher methods are the methods of encryption in which the characters of original text are replaced by some other characters. This substitution is done by a fixed predefined system.

39. Write down the types of Substitution Cipher Methods.

Ans. Types of Substitution Cipher Methods:

There are two commonly used cipher methods:

- Caesar Cipher
- Vigenere Cipher

40. Who is Caesar?

Ans. Caesar: Caesar was a Roman politician and military general who played a critical role in the rise of the Roman Empire. Caesar used this method of encryption for sending messages to his soldiers and generals. This is the reason for calling this method as Caesar Cipher.

41. What is Caesar Cipher method?

Ans. Caesar Cipher Method: In this method, we replace each alphabet in the plaintext by another alphabet. The replacing alphabet is some fixed number of steps to the left or right of original alphabet in the sequence of alphabets.

42. What is Vigenere Cipher?

Ans. Vigenere Cipher: Vigenere cipher is another substitution cipher, which uses a table known as Vigenere Cipher table for substitution the letters of plaintext.

43. What is Vigenere Cipher Table?

Ans. Vigenere Cipher Table: The Vigenere Cipher Table consists of 26 rows and 26 columns, where the 1st row contains the original alphabets from A - Z. In each subsequent row the alphabet is shifted by one letter to the right. All the columns are labeled by alphabets from A - Z and all the rows are also labeled by alphabets from A - Z.

44. What is Vigenere Cipher method?

Ans. Vigenere Cipher Method:

In this method we have a substitution key that is combined with the plaintext to generate the ciphertext. We encrypt each letter of the plaintext by finding that letter in column labels of the Vigenere Cipher table and in that column, we find a letter that is in front of the row label for the respective letter of the key. We continue this process until all the text is finished.

45. What is Vigenere Cipher Encryption Widget?

Ans. Vigenere Cipher Encryption Widget: Vigenere Cipher Encryption Widget shows animation of the encryption and decryption of plaintext by using Vigenere Cipher method according to a given key. This widget is available at the website: https://studio.code.org/s/vigenere/stage/1/puzzle/1.

46. What is meant by cybercrime?

Ans. Cybercrime: Any criminal activity which is performed by using computers and the Internet is known as cybercrime. A cybercrime can be downloading illegal music files or stealing millions of dollars from online bank accounts. It also includes crime like identity theft, threatening someone using Internet, etc.

47. Write down the forms of cybercrimes.

Ans. Forms of Cybercrimes: Some forms of cybercrimes are as follows:

- Identity theft
- Transaction fraud
- Advance fee fraud
- Hacking
- Piracy

48. What is meant by identity theft?

Ans. Identity Theft: One common form of cybercrime is identity theft. Hackers may use fake emails to trap someone to give passwords and account information.

49. What is meant by advance fee fraud?

Ans. Advance Fee Fraud: Sometimes the hackers congratulate you upon winning a big prize and ask you pay a small amount in advance, so that the prize can be dispatched. This is a common type of cybercrime. The lure of easy wealth has found many victims of these frauds.

50. Define hacking.

Ans. Hacking: Another cybercrime is the practice of hacking, illegally accessing someone else's computer. This happens mostly when you download some file from internet and execute it without knowing details.

51. Write down some effects of computer hacking.

Ans. Effects of Computer Hacking

- An unexplained decrease in hard drive space availability
- Files unexpectedly appear or grow in size
- Sudden computer or network performance changes
- Frequent crashes

52. Define spyware

Ans. Spyware: A software installed in your computer connects someone else to your computer without your permission. The aim is to gather information about a person or organization sometimes without their knowledge. This type of software is called spyware. It is the most common software which is installed on system without knowledge of the user. E.g. CoolWebSearch, Zlob Trojan

53. Define malware.

Ans. Malware: It is a term that can be used to describe a wide range of software that is written for malicious purpose. They can cause various types of problems to a computer system. Malware can consist of spyware, adware, viruses, worms, Trojans, etc.

54. Define worm.

Ans. Worm: Software that is developed to copy itself from one computer to another, without human interaction is known as worm. Unlike a computer virus, a worm can copy itself automatically over a network (via e-mail, downloading, uploading, etc).

55. Write down the problems caused by worm.

Ans. Problems caused by Worm: Worm can cause many problems. It may:

- Slow down the computer.
- Cause some programs to stop working.
- Destroy files stored on the computer.

56. Define adware.

Ans. Adware: Software that automatically displays or downloads advertisements on a computer is known as adware. It also tracks a user's browsing habits to show advertisements. These programs disrupt the privacy of the user and slow down the speed of the computer. E.g. Amazon Search, Arcade Safari

57. Define antivirus.

Ans. Antivirus: A software which protects a computer from viruses, worms, adware, etc. is known as an antivirus. It prevents, detects and removes viruses from a computer. E.g. Symantec, Norton, McAffe and etc.

58. Define phishing.

Ans. Phishing: Phishing is the fraudulent attempt by sending emails to obtain sensitive information such as usernames, password and credit card details.

59. Write down any two characteristics of a phishing website.

Ans. Characteristics of a Phishing Website

Characteristics of a phishing website are as follows:

- It looks like original due to same contents such as images, texts, logos, colour schemes etc.
- It may contain actual links to web contents of the legitimate website such as contact us, privacy or disclaimer to trick the visitors.

60. Write down the targets of DoS attackers.

Ans. Targets of DoS Attackers: DoS attackers often target web servers of high profile organizations such as banking, commerce and media companies or government and trade organizations. Though DoS attacks do not typically result in the theft or loss of significant information or other assets, they can cost the victim a great deal of time and money.

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UNIT 05

Designing Website

Q.1: What is HTML? Explain.

Ans. HTML

HTML stands for Hyper Text Markup language. It is a simple language to create webpages. When you send request to a web server through a web browser to access a webpage, you get HTML as a response from there. The web browser understands the HTML and displays contents of the webpage. HTML tells the browser how the contents are structured inside a webpage.

HTML is not case sensitive. It means that a tag written in uppercase is not different from the one written in lowercase. For example, the paragraph tag p can be written as <P> or <p>.

There are two important terms that you need to understand in the name HTML:

- **Hypertext**
- **Markup Language**

a) Hypertext

The term hypertext is used due to the special text in a webpage called hyperlinks. By clicking on these links you can move from one webpage to another. Hyperlinnks are used to navigate on the World Wide Web (WWW).

b) Markup Language

A webpage consists of a series of elements which are represented by tags. For example, if you need a paragraph of text on your webpage, you use it as:

<p> Some Text Here </p>

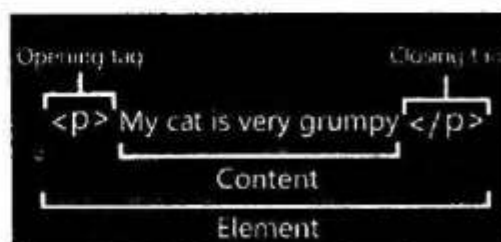
Here <p> shows marking of paragraph opening tag and </p> means marking of paragraph closing tag. Due to marking of each element, it is called a markup language.

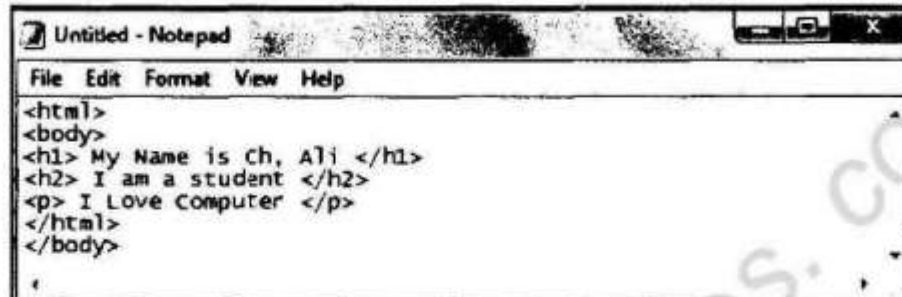
Example of Tag in HTML

<p> My Name is Ali </p>

<P> I am a student </P>

<P> I am in Class 10 </p>

<p> I Love Computer </P>

Q.2: Write down the procedure to create a webpage and display it.

Ans. Creating and displaying a webpage.

To create a webpage, you need a text editor, a software to edit text in a file. In MS Windows, you can use Notepad and in MAC operating system you use TextEdit. You

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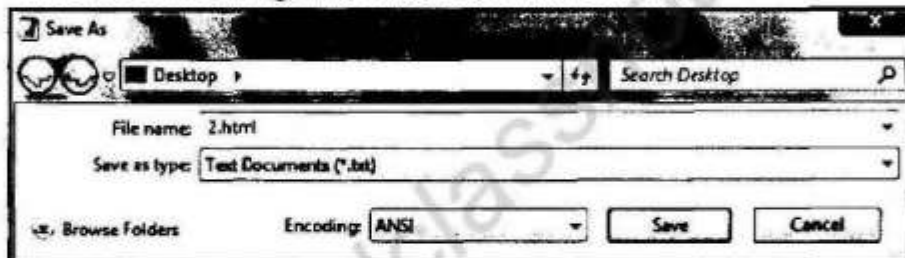
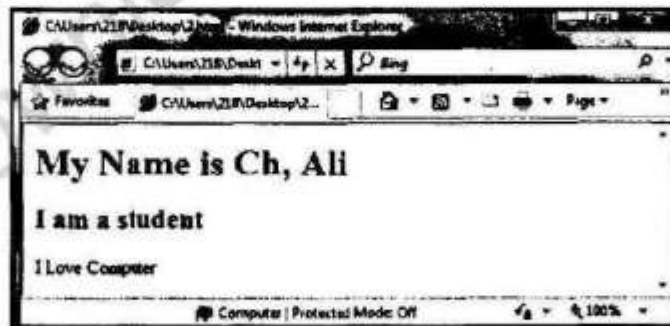
follow these four steps to create your first webpage.

Step 1: Open text editor.

Step 2: Write some HTML content.

Example of HTML

Step 3: Save the HTML Page with extension .htm or html.

Saving HTML File

Step4: In order to view your first webpage, just double click the HTML file you saved in step 3. A web browser is automatically opened to show your webpage as shown in figure below:

My First webpage

Q.3: Explain different tags used in an HTML document.

Ans. Types of Tags used in an HTML document

There are two types of tags used in an HTML document.

- Paired Tags
- Singular Tags

a) Paired Tags

Most of the tags in HTML are paired tags. They consist of a start tag, an end tag and contents between them. Following is the general structure of paired tags:

<tagname> Contents </tagname>

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Example:

For example, tag p to create a paragraph in HTML document is a paired tag.

<p> My Name is CH: Ali </p>

b) Singular Tags

Some tags do not have closing tags and they are called singular tags or empty tags. They are simply written as <tagname>. For example <br> for line break, <hr> to insert a horizontal line.

Q.4: What is meant by attributes in HTML Tags?

Ans. Attributes in HTML Tags

Attributes are the properties associated with tags. They provide some information with respect to a specific tag. Each attribute is given a value. Generally, a tag with attributes is written as:

<tagname attribute1="value" attribute2="value"….attribute N="value">

For example, <p align="center"> Content </p> shows the content of a paragraph at center with respect to left and right margins.

Q.5: Describe different sections in a webpage.

Ans. Main Sections in a Webpage.

Main sections in a webpage are as follows:

- HTML
- Head Section
- Body Section

a) HTML

The HTML document begins with the tag <html> and ends with </html>. It is the top level tag that contains the whole contents of a webpage. An HTML document primarily consists of two sections, Head section and a Body section.

Sections of a Webpage

b) Head Section

Head section typically defines the document title, styles and other information about the whole document. Head section starts with <head> tag and ends with </head>. To specify title of the webpage, you use <title> tag inside <head> </head> tags. Above

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figure shows an example, where we set the title of the webpage as "Welcome to class 9 of my school" by writing it inside <title> </title> tags.

c) Body Section

Body section contains the actual contents of a webpage that are visible inside a webpage. This section starts with <body> tag and ends with </body>.

Q.6: What is meant by content formatting in HTML? Explain.

Ans. Content Formatting in HTML

HTML defines special elements for defining text with a special meaning. The description about performing various content formatting tasks in HTML, are as follows:

a) Creating a Paragraph

The <p> tag marks starting of a paragraph, and </p> tag marks closing of the paragraph. The text inside <p> </p> tags is actual contents of the paragraph.

b) Insert line Breaks:

the <br> element inserts a line break without starting a new paragraph. For example, <p> this is <br> a paragraph </p> displays text in two lines, as following.

This is
A paragraph

c) Insert Spaces

If you insert multiple spaces in a text, HTML only considers one space and ignores the others. For example, <p> I am a Student. </p> generates the following output.

I am a Student.

You can see that HTML has ignored the multiple spaces inside the text. In order to insert spaces you need to write " " where the space is needed. For example, <p> I am   Student </p> generates the following output.

I am   Student

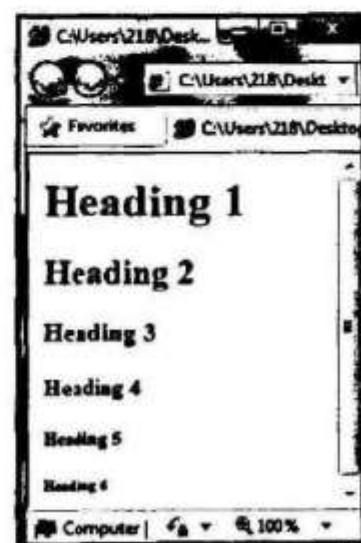
In order to add two spaces, you can use " ".

d) Add headings/ sub-headings

Headings are defined with the <h1> to <h6> tags. <h1> defines the most important heading. <h6> defines the least important heading. For example, <h1> Heading 1 </h1> <h2> Heading 2</h2> <h3> Heading 3</h3> <h4> Heading 4</h4> <h5> Heading 5</h5> <h6> Heading 6</h6> produces the output as shown in the figure given:

Q.7: Describe the basic text formatting tags.

Ans. Text Formatting Tags

The formatting tags are used to format the text in

HTML documents. The tag specifies the font styles, font size and colour of text. You can use colour attributes of the tag to specify the colour of text. For specifying the size of text, size attributes is used. Similarly, face attribute is used to set the font style of text. For example, some text .

Example:

HTML Code Snippet	Output
 Pakistan Zindabad 	**Pakistan Zindabad**
 Pakistan Zindabad 	*Pakistan Zindabad*
 Pakistan Zindabad 	Pakistan Zindabad

The <font> tag is deprecated in HTML 5, the latest version of HTML. It uses tags like , <i>, <u> to make text bold, italic or underline respectively.

Example:

HTML Code Snippet	Output
 Pakistan Zindabad 	**Pakistan Zindabad**
<i> Pakistan Zindabad </i>	*Pakistan Zindabad*
<u> Pakistan Zindabad </u>	Pakistan Zindabad

Q.8: Describe lists.

Ans. Lists

Sometimes, you need to provide information in the form of lists e.g. list of subjects, list of teachers, list of friends etc.

Types of Lists

There are following four types of lists in HTML:

- Ordered List
- Unordered List
- Definition List
- Nested Lists

i) Ordered List

An ordered list keeps each list item with an order number. If you change the order, the meaning of the whole list may also change. For example, if your teacher makes a list of students with respect to their marks then definitely order will matter. An ordered list starts with <ol> and ends with tag. Each list item starts with <li> tag.

Example:

HTML Code Snippet	Output
  - First Item - Second Item - Third Item - Fourth Item - Fifth Item 	1. First Item 2. Second Item 3. Third Item 4. Fourth Item 5. Fifth Item

b) Unordered List

In an unordered list, the order of the list items is not important. In other words, shuffling of items in an unordered list has no effect. For example, list of cities in Pakistan. An unordered list is created inside the <ul> tags. Each list item is added with <li> tag.

Example:

HTML Code Snippet	Output
  - Lahore - Karachi - Multan - Vehari - Islamabad 	• Lahore • Karachi • Multan • Vehari • Islamabad

c) Definition List

There is another type of list, called definition list or description list. It is used when you need to show some terms and their descriptions. For example, if you want to write names of subjects you are studying in 9th class along with their introduction then this type of list is helpful. The <dl> tag is used to define the description list, the <dt> tag specifies the term and the <dd> tag describes that term.

Example:

HTML Code Snippet	Output
<dl> <dt> Coffee </dt> <dd> -black hot drink </dd> <dt> Milk </dt> <dd> -white cold drink </dd> </dl>	Coffee -black hot drink Milk -white cold drink

d) Nested Lists

In a list, a list item can contain another list. Such list is called a nested list. It is useful for situations where you have multiple options for a single item in a list e.g. for writing table of contents that contain sub-sections.

Example:

HTML Code Snippet	Output
  - Coffee - Tea - Black Coffee - Green tea - Milk 	• Coffee • Tea 　• Black Coffee 　• Green tea • Milk

Q.9: How would you add image and set backgrounds to a webpage?

Ans. Images and Backgrounds

In a webpage, images are added with the <img> tag in HTML. The <img> tag is an empty tag but it contains attributes of an image. For example, the **src** attribute specifies the URL (Uniform Resource Locator), a web address of the image. <img src="url">

- ### Adding an Image

Images can improve the design and the appearance of a webpage. In HTML, images are added with the <img> tag. The attributes "width" and "height" can be used to specify the width and height of the image respectively. The "border" attribute can be used to specify the border size around the image. The alt attribute provides an alternate text for an image, if the image is not displayed due to any reason.

Example:

```
<img src="https://www.publicdomainpictures.net/pictures/180000/velka/tree-1465369020Wxg.jpg"
    Border="2" width ="200" height ="200" alt ="A Green Tree">
```

The output is shown below:

HTML image

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- **Applying Background and Foreground Colours to a Webpage**

The bgcolor attribute of <body> tag specifies the background colour of a document and text attribute specifies the foreground text colour of the webpage. These attributes are no longer supported in HTML5.

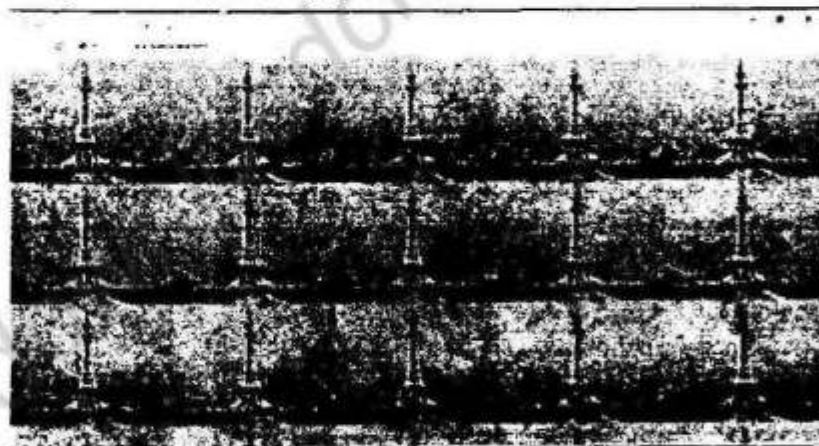
Example:

```
<body bgcolor ="#E6E6FA" text="red">
<h1> Hello World!</h1>
</body>
```

- **Assign a background image to the webpage.**

The background attribute of the <body> tag specifies the background image of a document or webpage.

Example:

```
<body background="myimage.jpg">
```

Background Image

Q.10: What is the difference between hyperlink and anchor?

Ans. Hyperlink

Hyperlink is such an icon, graphic, or text in a webpage, that when clicked, takes you to some other webpage.

- **Create a Hyperlink to a Webpage**

The <a> tag is used to create a hyperlink in a webpage. The href attribute is used to specify the URL of the linked webpage. For example, Visit www.google.com makes the text "Visit www.google.com" a hyperlink. If you click on this text in the webpage, it takes you to the website www.google.com

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Define an anchor

Anchor links allow you to go from one part of the same page to another part. Both hyperlinks and anchors are defined by the HTML anchor element <a>

Create an anchor to hyperlink within a webpage

Suppose you have an html page with a lot of text, and after reaching bottom of the page, user needs to scroll up to reach the top of page. You can add a link at the bottom of page that takes the user directly to the top of page. For this purpose, you need to follow these steps:

1. Create an anchor at the top of page, and give it a name, e.g.
2. Create an anchor link at the bottom of page that uses href attribute to link to the anchor created in 1st step. Name of the anchor should be preceded by # sign in the href attribute, e.g. Go to top

You can give any name to an anchor, and then use the same name with preceding # sign to move to that anchor.

Top of page!
This is top of the page with text.
...
...
...
...
...
...

Anchor example

In the figure, by clicking the "Go to top" link you will jump back to the top of the page.

...
...
...
...
...
...
End of Page!
This is end of the page with text
Go to Top

Anchor link example

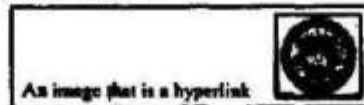
Create a graphical Hyperlink

You can also use an image as a hyperlink by using the <img> tag inside the <a> tags.

Example:

We can see this in the following example. An image that is a hyperlink:

```
<a href="https://www.google.com">
  <img src="smiley.gif" alt="Go to google! "Width ="50" height="50" border="1"> </a>
```

The output is shown in given figure.

Q.11: Write down the procedure to create tables.

Ans. Creating Tables:

In HTML, a table is defined with the <table> tag. Each table row is defined with the <tr> tag. A table header is defined with the <th> tag. A table data or cell is defined with the <td> tag.

Example:

See the following example with the output:

```
<table>
    <tr>
        <th> Roll No.</th> <th> Name </th> <th> Age</th>
    </tr>
    <tr>
        <td> 1</td> <td> Ahmad </td> <td> 19</td>
    </tr>
    <tr>
        <td> 2</td> <td> Hashmat </td> <td> 44</td>
    </tr>
    <tr>
        <td> 3</td> <td> Asad </td> <td> 21</td>
    </tr>
</table>
```

Output

Roll No	Name	Age
1	Ahmad	19
2	Hashmat	44
3	Asad	21

Applying the Table Properties

There are two properties which can be applied on the tables:

- colspan
- rowspan

a) colspan

To make a cell span more than one columns, colspan attribute is used.

Example:

```
<table>
    <tr>
        <th>Name</th> <th colspan="2">Telephone</th>
```

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```
    </tr>
    <tr>
        <td> Muhammad Ahmad</td>
        <td> 0423-5861923</td>
        <td> 0332-4398344</td>
    </tr>
</table>
```

Output

Name	Telephone	
Muhammad Ahmad	0423-5861923	0332-4398344

- **rowspan**

  To make a cell span more than one row, rowspan attribute is used.

Example:

```
<table>
    <tr>
        <th>Name:</th>
        <td> Muhammad Ahmad</td>
    </tr>
    <tr>
        <th rowspan="2"> Telephone:</th>
        <td> 0423-5861923</td>
    </tr>
    <tr>
        <td> 0332-4398344</td>
    </tr>
</table>
```

Output

Name	Muhammad Ahmad
Telephone:	0423-5861923
	0332-4398344

Summary

- HTML, is Hypertext Markup Language and its purpose is to create a webpage.
- A website consist of webpages.
- The head element is a container for metadata.
- The visible part of the HTML document is between <body> and </body>.
- Text formatting refers to the attributes of text other than the actual text itself.

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- There are different types of lists in HTML such as unordered, ordered and description lists.
- Hyperlink is an icon, graphic, or text in a document by which you move around on the other documents.
- To move from one part of the same page to the other page we use anchor.
- In HTML the <table> tag defines table.

SOLVED EXERCISE

5.1 Choose the correct option.

1. An individual list item can contain another entire list called __________

(i) Ordered list (ii) Unordered list
(iii) Nested list (iv) Definition list

2. HTML is not a __________ language.

(i) Programming (ii) Markup
(iii) Both i and ii (iv) None of above

3. Webpages can be created and modified by using __________.

(i) Notepad ++ (ii) Notepad
(iii) TextEdit (iv) All of above

4. An HTML element usually consists of a __________ tags.

(i) Start (ii) End (iii) Start and End (iv) None of above

5. The __________ element is a container for metadata (data about data).

(i) <body> (ii) <head> (iii) <title> (iv) <html>

6. To save the HTML Page, you can use __________ as file extension.

(i) htm (ii) html (iii) xhtml (iv) Both i and ii

7. There are __________ of headings in HTML document.

(i) 4 (ii) 5 (iii) 6 (iv) 1

8. __________ tag is used to display data in tabular form.

(i) td (ii) table (iii) tr (iv) th

9. A hyperlink can be applied to __________

(i) image (ii) text (iii) Both i and ii (iv) None of above

10. In "body" tag __________ is used to make picture of a background image of a webpage?

(i) bg (ii) background (iii) bgiamge (iv) Both i and ii

Answers:

1. Nested list **2.** Programming **3.** All of above **4.** Start and End **5.** <head>
6. Both i and ii **7.** 6 **8.** table **9.** Both i and ii **10.** background

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5.2 Fill in the blanks.

1. ______________ make a cell span more than one row.
2. By clicking on special text called ______________ which bring you to the next page.
3. The ______________ attribute specifies the foreground colour of the webpage.
4. In HTML, images are defined with the ______________ tag.
5. ______________ refers to the way tags are used to define the page layout and elements within the page.
6. HTML is a computer language which is used to create ______________.
7. ______________ tag makes the enclosed text bold.
8. Tags and text that are not directly displayed on the page are written in ______________ section.
9. ______________ tag is used for inserting a line break.
10. ______________ attribute is used with img tag to display the text if image could not load in browser.

Answers:

1.	Rospan	2.	hyperlink	3.	text	4.	<img>	5.	A markup language
6.	a webpage	7.	<b>	8.	<head>	9.	 	10.	Alt

5.3 Give Short Answers.

1. **Differentiate between ordered and unordered list.**

Ans. See question no. 8

2. **Describe the basic text formatting tags.**

Ans. See question no. 7

3. **What is difference between hyperlink and anchor?**

Ans. See question no. 10

4. **Create a basic table with following attributes:**
   - **colspan**
   - **rowspan**

Ans. See question no. 11

5. **Explain the steps involved to create a HTML page.**

Ans. See question no. 2

5.4 Write the output of the following HTML.

```
<html>
<head>
<title> My Webpage</title>
</head>
<body>
<ol>
    <li> Sports
        <dl>
```

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```
                <dt>Cricket</dt>
                        <dd>Each team has 11 players</dd>
                <dt>Badminton</dt>
                        <dd>Each team has 1 or 2 players </dd>
                <dt>Chess</dt>
                        <dd>Each team has exactly 1 player</dd>
            </dl>
        </li>
        <li> Cities of Pakistan
            <dl>
                <dt>Lahore</dt>
                        <dd>Capital of Punjab</dd>
                <dt> Karachi </dt>
                        <dd>Capital of Sindh</dd>
                <dt>Peshawar</dt>
                        <dd>Capital of Khyber Pakhtunkhwa</dd>
                <dt>Quetta</dt>
                        <dd>Capital of Balochistan</dd>
            </dl>
        </li>
</ol>
</body>
</html>
```

Favorites | My Webpage

1. Sports
   Cricket
       Each team has 11 players
   Badminton
       Each team has 1 or 2 players
   Chess
       Each team has exactly 1 player
2. Cities of Pakistan
   Lahore
       Capital of Punjab
   Karachi
       Capital of Sindh
   Peshawar
       Capital of Khyber Pakhtunkhwa
   Quetta
       Capital of Balochistan
3.

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5.5 Write HTML to get the following output.

Algorithms

Plain Interest Calculation

This algorithm takes number of years, amount and interest rate as input and produces total plain interest

1. Start
2. Input numbers years, amount, rate
3. Set Plain Interest to years * (amount*rate/100)
4. Print Plain Interest
5. Stop

Acceleration Calculation

This algorithm takes mass and force as input and produces acceleration

1. Start
2. Input numbers mass, force
3. Set Acc to force/mass
4. Print Acc
5. Stop

Ans.

```
<html>
<head>
<title>
        output
</title>
</head>
<body>
<ul>
<li>
        <b>Algorithms</b>
</li>
<h4>Plain Interest Calculations</h4>
<p>This algorithm takes number of years, amount and interest rate as input and
produces total plain interest </p>
<ol>
        <li>Start</li>
        <li>Input numbers years, amount, rate</li>
        <li>Set Plain interest to years * (amount*rate/100)</li>
```

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```
        <li>Print Plain Interest</li>
        <li>Stop</li>
</ol>
        <h5>Acceleration Calculation</h5>
        <p>This algorithm takes mass and force as input and produces
acceleration</p>
<ol>
        <li>Start</li>
        <li>Input numbers mass and force</li>
        <li>Set Acc to force/mass</li>
        <li>Print Acc</li>
        <li>Stop</li>
</ol>
</ul>
</body>
</html>
```

Objective Type Questions

- **Choose the correct answer:**

1. **HTML stands for:**
   (a) Hypertext Markup Language (b) Hypertext Makeup Language
   (c) High Markup Language (d) None of These
2. **Its purpose is to create a webpage.**
   (a) C++ (b) HTML (c) High Markup Language (d) None of These
3. **__________ refers to the way tags are used to define the page layout and elements within the page.**
   (a) Markup Language (b) BASIC Language
   (c) C++ Language (d) None of these
4. **HTML is a computer language which is used to create __________.**
   (a) Games (b) Presentations (c) Spreadsheets (d) Webpages
5. **A website consists of:**
   (a) Webpages (b) Documents (c) Presentations (d) Images
6. **__________ is used to navigate on the World Wide Web (WWW).**
   (a) Anchor (b) Hypertext (c) Navigation (d) None of these
7. **Types of tags used in an HTML document:**
   (a) Paired (b) Singular (c) Both (a) & (b) (d) None of these

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8. Most of the tags in HTML are _________ tags.
(a) Paired (b) Singular (c) Both (a) & (b) (d) None of these

9. Main sections in a webpage:
(a) 6 (b) 5 (c) 4 (d) 3

10. It is the top level tag that contains the whole contents of a webpage.
(a) <Body> (b) <html> (c) <Head> (d) <tr>

11. The ________ element is a container for metadata.
(a) Body (b) Section (c) Head (d) Center

12. An HTML document primarily consists of sections:
(a) 8 (b) 6 (c) 4 (d) 2

13. There are ________ different types of lists in HTML.
(a) 8 (b) 6 (c) 5 (d) 4

14. Different types of lists in HTML:
(a) Ordered (b) Unordered (c) Nested (d) All of These

15. __________ is an icon, graphic, or text in a document by which you move around on the other documents.
(a) Hyperlink (b) head (c) body (d) URL

16. To move from one part of the same page to the other page we use:
(a) Hyperlink (b) Anchor (c) html (d) url

17. ____________ tag makes the enclosed text bold.
(a) <tb> (b) <tr> (c) <f> (d) <b>

18. Tags and text that are not directly displayed on the page are written in ____________ section.
(a) <body> (b) <head> (c) <tb> (d)

19. This section starts with <body> tag and ends with </body>.
(a) Hyperlink (b) head (c) body (d) url

20. Various content formatting tasks in HTML, are:
(a) Creating a Paragraph (b) Insert line Breaks
(c) Insert Spaces (d) All of these

21. The text inside <p> </p> tags is actual contents of the:
(a) Paragraph (b) Section (c) Document (d) Webpage

22. ___________ are defined with the <h1> to <h6> tags.
(a) Section (b) Paragraph (c) Headings (d) Webpage

23. _________ defines the most important heading.
(a) <h4> (b) <h3> (c) <h2> (d) <h1>

24. ____________ defines the least important heading.
(a) <h6> (b) <h5> (c) <h4> (d) <h3>

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25. __________ **tag is used for inserting a line break.**
(a) <body> (b) <head> (c) <td> (d)

26. __________ **attribute is used with img tag to display the text if image could not load in browser.**
(a) Alt (b) img (c) td (d) tab

27. The <font> tag specifies the:
(a) Font Styles (b) Font Size (c) Font Colour (d) All of These

28. An ordered list starts with __________ tag.
(a) (b) (c) <td> (d)

29. Each list item starts with __________ tag.
(a) (b) (c) <td> (d)

30. An unordered list is created inside the________ tag.
(a) (b) (c) (d)

31. The __________ tag is used to define the description list.
(a) (b) (c) (d) <dl>

32. The ________ tag specifies the term in the definition list.
(a) <dt> (b) (c) (d)

33. In HTML the ________ tag defines table.
(a) <td> (b) (c) <table> (d)

34. __________ **make a cell span more than one row.**
(a) rospan (b) colspan (c) rowspan (d) row

35. __________ **make a cell span more than one columns.**
(a) rospan (b) colspan (c) rowspan (d) row

36. In HTML, images are defined with the __________ tag.
(a) <table> (b) <text> (c) <img> (d) <pic>

Answers:

1.	Hypertext Markup Language	**2.**	HTML	**3.**	Markup Language				
4.	Webpages	**5.**	Webpages	**6.**	Hypertext	**7.**	Both (a) & (b)	**8.**	Paired
9.	3	**10.**	<html>	**11.**	Head	**12.**	2	**13.**	4
14.	All of These	**15.**	Hyperlink	**16.**	Anchor	**17.**	<b>	**18.**	<head>
19.	body	**20.**	All of these	**21.**	Paragraph	**22.**	Headings	**23.**	<h1>
24.	<h6>	**25.**	 	**26.**	Alt	**27.**	All of These	**28.**	
29.		**30.**		**31.**	<dl>	**32.**	<dt>	**33.**	<table>
34.	rospan	**35.**	colspan	**36.**	<img>				

- **Give Short Answers:**

1. What is HTML?

Ans. HTML: HTML stands for Hyper Text Markup language. It is a simple language to create webpages. When you send request to a web server through a web browser to access a webpage, you get HTML as a response from there. The web browser

understands the HTML and displays contents of the webpage. HTML tells the browser how the contents are structured inside a webpage.

2. What are the important terms of HTML?

Ans. There are two important terms that you need to understand in the name HTML:

- Hypertext
- Markup Language

3. Define hypertext.

Ans. Hypertext: The term hypertext is used due to the special text in a webpage called hyperlinks. By clicking on these links you can move from one webpage to another. Hyperlinks are used to navigate on the World Wide Web (WWW).

4. Define markup language.

Ans.Markup Language: A markup language is a computer language that uses tags to define elements within a document. It is human-readable, meaning markup files contain standard words, rather than typical programming syntax. While several markup languages exist, the two most popular are HTML and XML.

5. Define webpage.

Ans. Webpage: A Web page is a document for the World Wide Web that is identified by a unique uniform resource locator (URL). A Web page can be accessed and displayed on a monitor or mobile device through a Web browser. The data found in a Web page is usually in HTML or XHTML format. A webpage consists of a series of elements which are represented by tags.

6. In which software you create a webpage?

Ans. Creating and displaying a webpage.

To create a webpage, you need a text editor, a software to edit text in a file. In MS Windows, you can use Notepad and in MAC operating system you use TextEdit.

7. Write down different tags used in an HTML document.

Ans. Types of Tags used in an HTML document

There are two types of tags used in an HTML document.

- Paired Tags
- Singular Tags

8. What is meant by paired tags in HTML?

Ans. Paired Tags: Most of the tags in HTML are paired tags. They consist of a start tag, an end tag and contents between them. For example, tag p to create a paragraph in HTML document is a paired tag.

<p> My Name is CH: Ali </p>

9. Write down the general structure of paired tags.

Ans. Syntax of Paired Tags:

Following is the general structure of paired tags:

<tagname> Contents </tagname>

10. What is meant by singular tags in HTML?

Ans. Singular Tags: Some tags do not have closing tags and they are called singular

tags or empty tags. They are simply written as <tagname>. For example <br> for line break, <hr> to insert a horizontal line.

11. What is meant by attributes in HTML Tags?

Ans. Attributes in HTML Tags: Attributes are the properties associated with tags. They provide some information with respect to a specific tag. Each attribute is given a value.

12. Write down the procedure to write a tag with attributes.

Ans. Generally, a tag with attributes is written as:

<tagname attribute1="value" attribute2="value"....attribute N="value">

For example, <p align="center"> Content </p> shows the content of a paragraph at center with respect to left and right margins.

13. Write down the different sections in a webpage.

Ans. Main Sections in a Webpage.

Main sections in a webpage are as follows:

- HTML
- Head Section
- Body Section

14. What is the use of <html> tag in HTML document?

Ans. <html> Tag: The HTML document begins with the tag <html> and ends with </html>. It is the top level tag that contains the whole contents of a webpage.

15. Write down the sections of an HTML document.

Ans. Sections of an HTML document:

An HTML document primarily consists of two sections:

- Head section
- Body section

16. What is the use of head section in an HTML document?

Ans. Head Section: Head section typically defines the document title, styles and other information about the whole document. Head section starts with <head> tag and ends with </head>. To specify title of the webpage, you use <title> tag inside <head> </head> tags.

17. What is the use of body section in an HTML document?

Ans. Body Section: Body section contains the actual contents of a webpage that are visible inside a webpage. This section starts with <body> tag and ends with </body>.

18. What is meant by content formatting in HTML?

Ans: Content Formatting in HTML:

HTML defines special elements for defining text with a special meaning. Various content formatting tasks in HTML, are as follows:

- Creating a Paragraph
- Insert line Breaks
- Insert Spaces
- Add headings/ sub-headings

19. What tag is used to create a paragraph in an HTML document?

Ans. Creating a Paragraph: The <p> tag marks starting of a paragraph, and </p> tag

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marks closing of the paragraph. The text inside <p> </p> tags is actual contents of the paragraph.

20. What tag is used to insert line breaks in an HTML document?

Ans. Inserting line Breaks: The <br> element inserts a line break without starting a new paragraph. For example, <p> This is <br> a paragraph </p> displays text in two lines, as following.

This is
a paragraph

21. How would you insert spaces in an HTML document?

Ans. Inserting Spaces: If you insert multiple spaces in a text, HTML only considers one space and ignores the others. In order to insert spaces you need to write " " where the space is needed. For example, <p> I am   Student </p> generates the following output.

I am   Student

22. How would you add heading in an HTML document?

Ans. Add headings/ sub-headings: Headings are defined with the <h1> to <h6> tags. <h1> defines the most important heading. <h6> defines the least important heading. For example. <h1> Heading 1 </h1> <h2> Heading 2</h2> <h3> Heading 3</h3> <h4> Heading 4</h4> <h5> Heading 5</h5> <h6> Heading 6</h6>

23. What is the use of text formatting tags?

Ans. Text Formatting Tags: The formatting tags are used to format the text in HTML documents. The tag specifies the font styles, font size and colour of text. You can use colour attributes of the tag to specify the colour of text. For specifying the size of text, size attributes is used. Similarly, face attribute is used to set the font style of text. For example, some text .

24. Write down the types of lists in HTML document.

Ans. Types of Lists:

There are following four types of lists in HTML:

- Ordered List
- Unordered List
- Definition List
- Nested Lists

25. What is meant by ordered list in HTML document?

Ans. Ordered List: An ordered list keeps each list item with an order number. If you change the order, the meaning of the whole list may also change. For example, if your teacher makes a list of students with respect to their marks then definitely order

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will matter. An ordered list starts with <ol> tag. Each list item starts with <li> tag.

26. Write down an example of ordered list in HTML document?

Ans. Example

```
<ol>
  <li>First item</li>
  <li>Second item</li>
  <li>Third item</li>
 </ol>
```

27. What is meant by unordered list in HTML document?

Ans. Unordered List: In an unordered list, the order of the list items is not important. In other words, shuffling of items in an unordered list has no effect. For example, list of cities in Pakistan. An unordered list is created inside the <ul> tags. Each list item is added with <li> tag.

28. Write down an example of unordered list in HTML document?

Ans. Example

```
<ul>
  <li>First item</li>
  <li>Second item</li>
  <li>Third item</li>
 </ul>
```

29. What is meant by definition list in HTML document?

Ans. Definition List: There is another type of list, called definition list or description list. It is used when you need to show some terms and their descriptions. For example, if you want to write names of subjects you are studying in 9th class along with their introduction then this type of list is helpful. The <dl> tag is used to define the description list, the <dt> tag specifies the term and the <dd> tag describes that item.

30. Write down an example of definition list in HTML document?

Ans. Example

```
<dl>
      <dt> Coffee </dt>
      <dd> -black hot drink </dd>
      <dt> Milk </dt>
      <dd> -white cold drink </dd>
</dl>
```

31. Define nested list.

Ans. Nested Lists: In a list, a list item can contain another list. Such list is called a nested list. It is useful for situations where you have multiple options for a single item in a list e.g. For writing table of contents that contain sub-sections.

32. Write down an example of nested list in HTML document?

Ans. Example

```
<ul>
<li> Coffee </li>
<li> Tea
        <ul>
              <li> Black Coffee </li>
              <li> Green tea </li>
        </ul>
</li>
<li>
<li> Milk</li>
</ul>
```

33. How would you add image to a webpage?

Ans. Images and Backgrounds: Images can improve the design and the appearance of a webpage. In HTML, images are added with the <img> tag. The attributes "width" and "height" can be used to specify the width and height of the image respectively. The "border" attribute can be used to specify the border size around the image. The alt attribute provides an alternate text for an image, if the image is not displayed due to any reason.

34. Write down an example to add image in HTML document?

Ans. Example

```
<img src
="https://www.publicdomainpictures.net/pictures/180000/velka/tree-1465369020Wxg.jpg"
Border="2" width ="200" height ="200" alt ="A Green Tree">
```

35. How would apply background and foreground colours to a webpage?

Ans. Applying Background and Foreground Colours to a Webpage:

The bgcolor attribute of <body> tag specifies the background colour of a document and text attribute specifies the foreground text colour of the webpage. These attributes are no longer supported in HTML5.

36. Write down an example of applying background and foreground colours to a webpage.

Ans. Example:

```
<body bgcolor ="#E6E6FA" text="red">
<h1> Hello World!</h1>
</body>
```

37. How would assign background image to the webpage?

Ans. Assigning a background image to the webpage:

The background attribute of the <body> tag specifies the background image of a

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document or webpage.

Example: <body background="myimage.jpg">

38. Define hyperlink.

Ans. Hyperlink: Hyperlink is such an icon, graphic, or text in a webpage, that when clicked, takes you to some other webpage.

39. How would you create a hyperlink to a webpage?

Ans. Creating a Hyperlink to a Webpage: The <a> tag is used to create a hyperlink in a webpage. The href attribute is used to specify the URL of the linked webpage. For example, Visit www.google.com makes the text "Visit www.google.com" a hyperlink. If you click on this text in the webpage, it takes you to the website www.google.com

40. Define an anchor.

Ans. Anchor: Anchor links allow you to go from one part of the same page to another part. Both hyperlinks and anchors are defined by the HTML anchor element <a>

41. How would you create a graphical hyperlink?

Ans. Creating a graphical Hyperlink:

You can use an image as a hyperlink by using the <img> tag inside the <a> tags.

42. Write down an example to create an image hyperlink.

Ans. Example:

```
<a href="https://www.google.com">
<img src="smiley.gif" alt="Go to google! "Width ="50" height="50" border="1">
</a>
```

43. Write down the procedure to create tables.

Ans. Creating Tables: In HTML, a table is defined with the <table> tag. Each table row is defined with the <tr> tag. A table header is defined with the <th> tag. A table data or cell is defined with the <td> tag.

44. Write down the properties which can be applied to the tables.

Ans. Applying the Table Properties:

There are two properties which can be applied on the tables:

- colspan
- rowspan

45. What is the use of colspan attribute?

Ans. Colspan: To make a cell span more than one columns, colspan attribute is used.

46. What is the use of rowspan attribute?

Ans. rowspan: To make a cell span more than one row, rowspan attribute is used.